SCIENTIFIC AMERICAN

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PHOTOGRAPHIC PRINTING BY MACHINERY.

This new process of rapid printing consists essentially of a roll of sensitized bromide paper a thousand yards in length by something over a yard in width, unwound in a room illuminated by red light, fed under two or more negatives, then automatically pressed upward by a platen against the face of the negative, at the same instant also automatically exposed by the flashing of incandescent electric lamps above the negatives, then moved along the proper distance for a fresh section to be exposed and finally wound up on another roller.

The roll of exposed film is next removed to another room and automatically developed, fixed, alumed, washed and dried, the finished pictures being wound up on a third roll from which they are cut to size and mounted on cards in the usual way.

Actually to see how easily and certainly this process works and learn of the obstacles that had to be overcome not only surprises but astonishes the old time photographer. It is, in fact, a new industry in the line of photographic printing and will be useful in hundreds of various kinds of businesses, where prints by hundreds or thousands from one negative are desired.

The accompanying illustrations sketched from the apparatus in operation give a very good idea of its construction and working.

Taking the exposing apparatus first, Fig. 1, the roll of unexposed paper supported on a shaft on the left may be seen hanging therefrom in a loose loop and enters the inclined apron, thence passes directly under the negatives, which are secured to the underside of a large sheet of glass by paper strips in the usual way. The glass plate is held in a removable frame, which permits the negatives to be easily located and secured. When the plate is in position vignetting masks are laid on top of the plate over the negative, and if, by a trial, the exposure has been found too long for one negative, thin sheets of waxed or tissue paper are interposed to weaken the light to the proper degree. Several negatives of a similar degree of density may thus be secured to the plate and each adapted to the light necessary for a proper exposure. Much care and nicety of judgment is required in this adjustment, as the success of the later manipulations hinges upon it. Above the negative plate is observed the exposing chamber suspended by a rope passing over a pulley, in the ceiling, and balanced at the other end by a weight; this arrangement permits the whole to be raised above the negative plate, giving easy access thereto for the adjustment of vignetting masks. In each side of the case are four 32 candle power incandescent electric lamps connected by flexible cords to a switch on the wall and to the automatic switch below. The heat from the lamps was found to be excessive and ventilation was obtained and the temperature kept quite uniform by forcing in a current of air with an electric fan or air pump. A square red window on the side allows one to observe that all the lamps go when the switch is turned on.

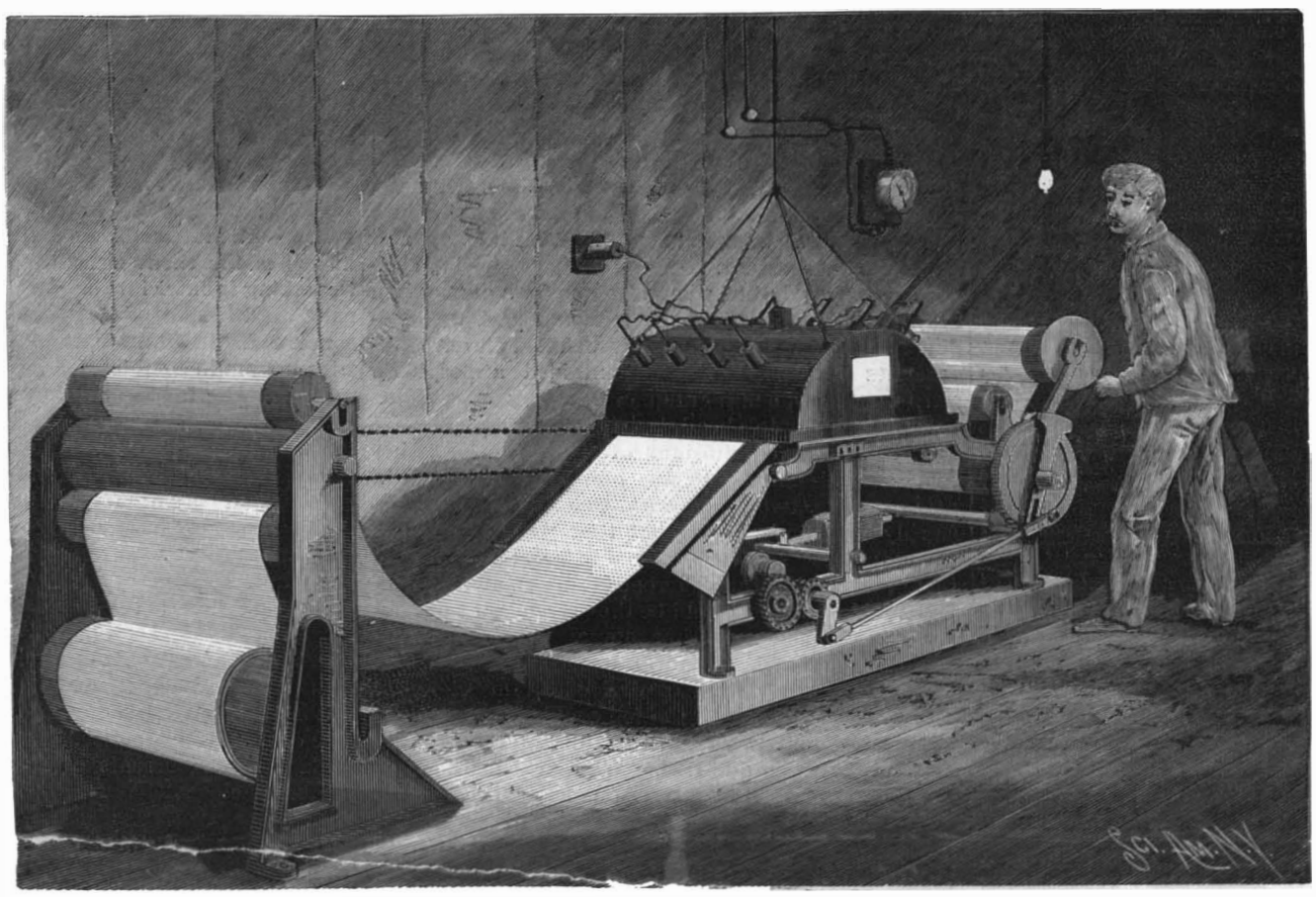

Fig. 1.—AUTOMATIC PHOTOGRAPHIC PRINTING—THE EXPOSING APPARATUS.

After exposure the paper is wound over a pull roll, adjoining the exposing chamber, by an intermittent quick movement equivalent to the length of the negative plate or at any set distance, passing thence to a roll whose axle works in ball bearings, on which it is wound, the roll being rotated by an attendant. A reciprocating motion is imparted to the pull roll by means of a connecting rod attached to a crank shaft located under the feed apron, at the lower left hand portion of the machine.

The end of the connecting rod at the pull roll engages in a slotted lever, the upper end of which has a ratchet and pawl operating in teeth on the periphery of the pull roll. The end of the rod may be moved nearer the center of the roll in the slotted lever, and so regulate the throw or amount of rotation. A sprocket wheel at the opposite end of the pull roll is connected by a chain with the feed roll. It is evident, therefore, when the pull roll makes a half revolution rapidly, the feed roll is also simultaneously rotated, causing the same amount of paper to be unwound as is taken up at the other end. Geared with the crank shaft under the feed apron is a shaft having a cam for operating at the right moment the electric switch for the lights and another cam for lowering the platen (see Fig. 2). Prior to the moment of exposure, the cam, as it rotates, permits the pivoted weight to draw the bell crank lever supporting the platen forward, and press the platen upward against the underside of the paper, placing the sensitive side of the latter in contact with the negatives during the interval of exposure (usually two seconds) it is then drawn down until a fresh section of paper passes under the negatives and the operation repeated. The movement is quite similar to the platen of a printing press.

The roll, containing two or three thousand exposures, is carefully protected from white light and carried to the room in which is located the automatic developing machinery. (Fig. 3.)

It is a most interesting sight to see the gradual development of the exposures here. As may be imagined, the exposed roll is set on supports at the right hand end of a long wood tank containing separate watertight compartments, and is carried over a roll into compartment No. 1, about 3½ feet deep, filled with 120 gallons of an old solution of ferrous oxalate of potash developer. Referring to Fig. 4, it will be noticed that half way

(Continued on p. 102.)

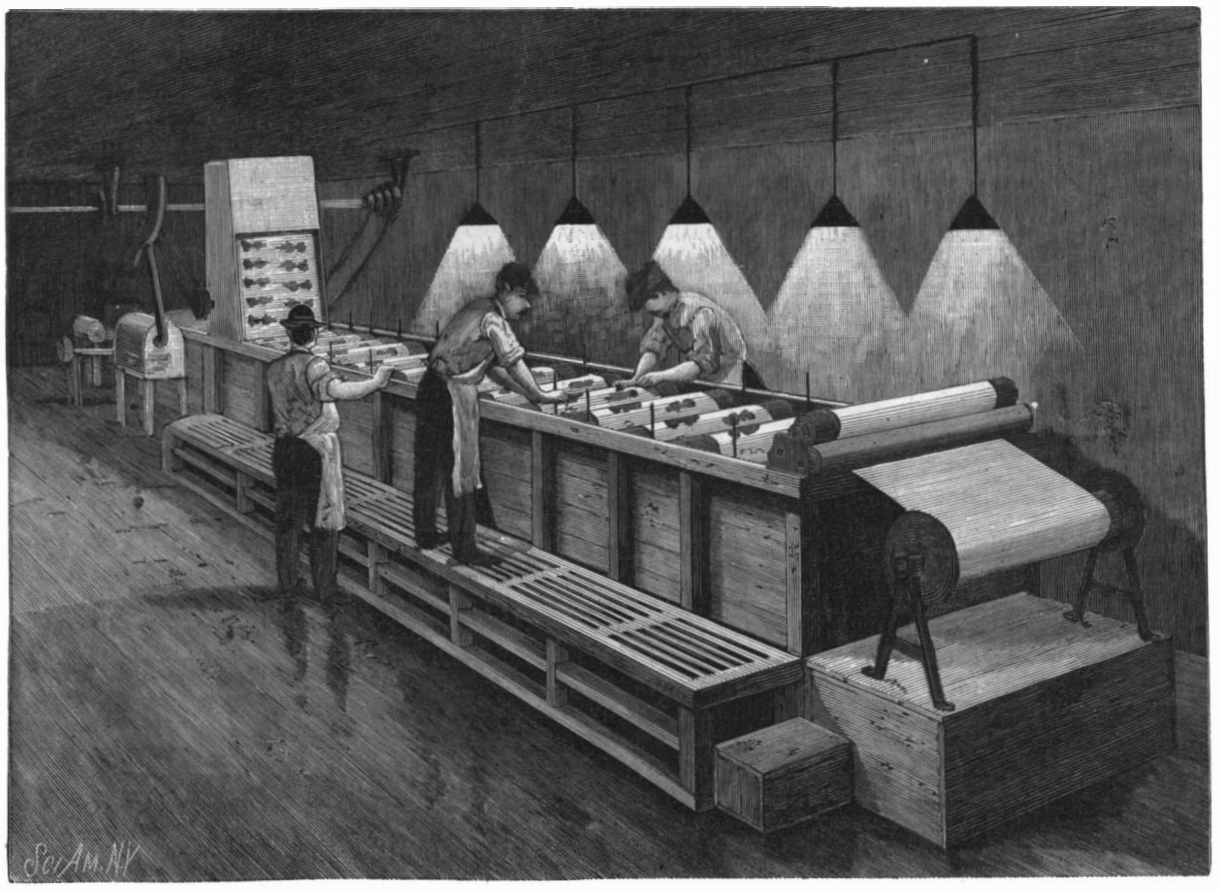

Fig. 3.—AUTOMATIC PHOTOGRAPHIC PRINTING—THE DEVELOPING APPARATUS.

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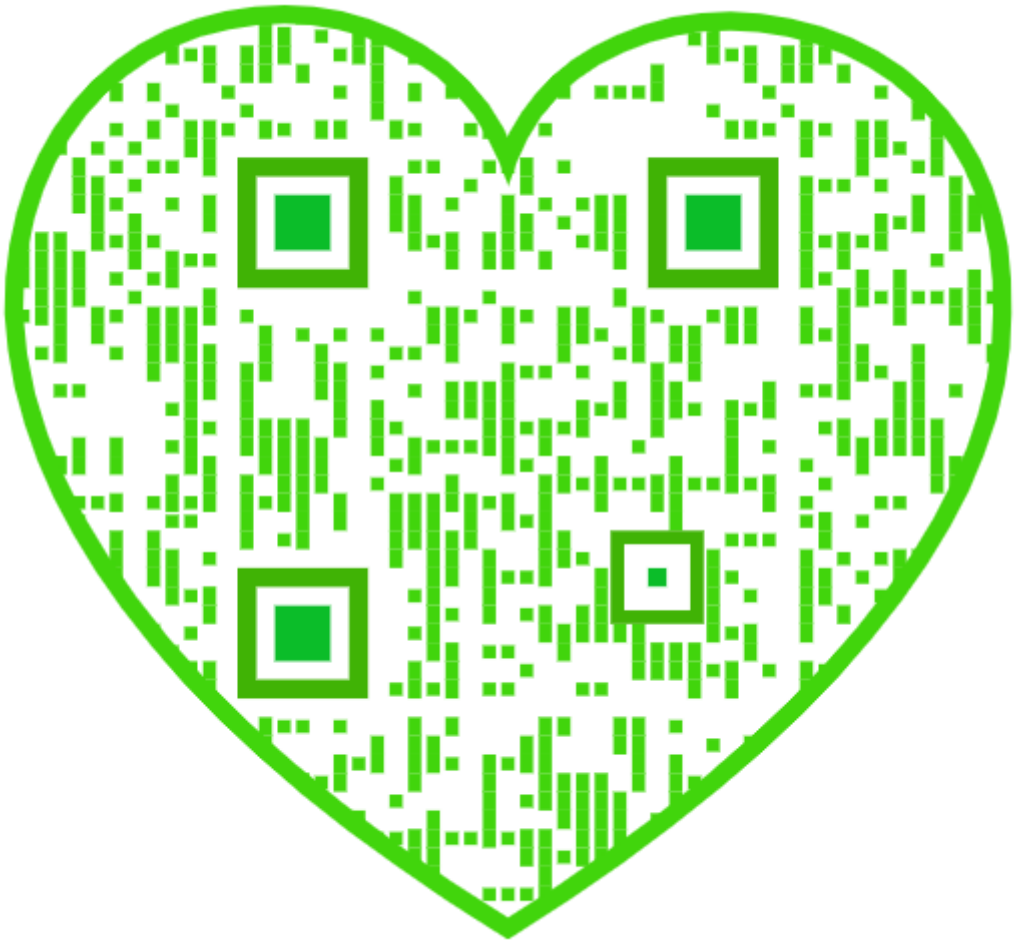

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Contents.

(Illustrated articles are marked with an asterisk.)

Argon, the discovery of..... 98
Atlanta Exposition notes..... 102
Bicycle notes..... 106
Bicycle tester, a*..... 100
Biological laboratory Cold Spring..... 99
Butterfly, tiger swallow-tail..... 106
Butter, sweetening rancid (6602)..... 109
Cable cars, Philadelphia..... 102
Che-foo, China*..... 107
Co-operation of French miners..... 106
Curves of least resistance..... 99
Dam, great, Pervar, India*..... 94
Dental surgery advancement..... 103
Dock, large, Southampton..... 100
Druggists' trials..... 101
Electrical items..... 98
Engines, compound reversing..... 101
Ferris wheel, a, in London..... 103
Fire department apparatus, Painter's*..... 100
Gas holder, a great..... 99
Gun lift battery test..... 102
Hair dyes (6601)..... 109
Horseless vehicle, the..... 107
Horses, do they weep?..... 108
Insects man's friends..... 103
Inventions recently patented..... 108
Inventors, rewards for..... 108
Lawn mower, Ingleton's*..... 100
Letter registering machine, Count di Brazza's..... 102
Levee building with force pumps 105
Lilac borer, the..... 106
Naphtha, the use of..... 102
Pasteur Institute, the Paris..... 107
Patents granted, weekly record.. 109
Photographic printing by machinery*..... 97
Photographs, enlarged..... 107
Photography of the retina..... 106
Pipe closer, Meyer's*..... 100
Prison, Tourah, Egypt..... 105
Psychology of a jury in trial..... 104
Railway cars, seasoned..... 101
Refrigerating plant, a (6600)..... 109
Signal service wanted..... 102
Teeth implantation..... 103
Tobacco factory, a primitive..... 103
War ships, British, cost of..... 108

TABLE OF CONTENTS OF

SCIENTIFIC AMERICAN SUPPLEMENT

No. 1024.

For the Week Ending August 17, 1895.

Price 10 cents. For sale by all newsdealers.

PAGE

I. ASTRONOMY.—The Electrical Measurement of Starlight.—Details of some remarkable experiments..... 16370

II. CHEMISTRY.—The Place of Argon among the Elements..... 16369

III. CIVIL ENGINEERING.—Bursting of the Canal Reservoir of Rousey, France.—A description of the terrible accident in which 117 people lost their lives and which entailed a damage of $10,000,000.—2 illustrations..... 16360

Russian Waterways..... 16365

IV. EDUCATION.—Educational Progress among the Blacks of the South.—By J. R. PRESTON..... 16260

V. GARDENING.—White Blackberry Iceberg.—1 illustration..... 16373

VI. MARINE ENGINEERING.—New Method of Fitting Shell and Deck Plating in Ships.—This article is accompanied by an engraving of an improved joggling machine.—2 illustrations..... 16364

VII. MECHANICAL ENGINEERING.—The Daimler Gas and Petroleum Motor.—A description of the well known motor which has been so successfully applied to automobile carriages.—This article is of great interest in view of the coming carriage races.—7 illustrations..... 16362

Electric Mining Plant.—Describes a continuous rope hauling engine, winding engine, and three-throw mining pump.—3 illustrations..... 16370

VIII. MISCELLANEOUS.—Use of Carrier Pigeons at Sea.—Details of maritime experiments with carrier pigeons instituted by the Petit-Journal, with a view to reporting accidents at sea.—2 illustrations..... 16365

Relics of Nelson Sold.—The prices brought by the historic relics which have just been sold..... 16360

IX. NATURAL HISTORY.—Pocket Gophers of the United States.. 16373

X. ORNITHOLOGY.—Fifty Years among Birds.—How birds change their color.—The mystery of migration..... 16374

Parrots Need Water..... 16373

XI. PHOTOGRAPHY.—Color Photography..... 16369

Mercurographic Methods of Photo-Engraving.—By THOMAS BOLAS..... 16366

XII. PHYSICS.—The Rotation of the Earth.—By M. F. O'REILLY.—6 illustrations..... 16372

XIII. PSYCHOLOGY.—Experimental Psychology.—By E. B. TITCHENER.—This article gives details of a number of interesting experiments..... 16360

XIV. TECHNOLOGY.—The Production of Aerated Waters on a Small Scale.—A description of the Lane and Pullman apparatus for carbonating water and cooling beverages on a small scale.—4 illustrations..... 16366

The Disposition of the Louisiana Molasses Crop.—By Dr. W. C. STUBBS.—An important paper on the disposition of molasses, of which a large quantity is now wasted annually, with many analyses..... 16368

Manufacture of White Pine Barrels.—7 illustrations..... 16367

Improved Still.—1 illustration..... 16366

XV. RAILWAYS.—Iron Clad Cars.—By J. W. GREEN..... 16364

XVI. TEXTILE.—Alarm for Apperly Feeds.—1 illustration..... 16367

THE DISCOVERY OF ARGON.

Some six years ago the Right Hon. Lord Rayleigh undertook one of the most difficult of chemico-physical measurements, namely, the determination of the densities of certain "permanent" gases. He established satisfactorily the densities of oxygen and hydrogen, but on undertaking that of nitrogen he was confronted with an anomaly, both curious and serious, which for some time he regarded only with "disgust and impatience."

Nitrogen to be weighed may be obtained from two entirely different sources—from the atmosphere, where it exists free, or from chemical compounds, such as ammonium nitrate, or nitric acid, in which it exists in combination with other substances. The air, as everybody knows, consists chiefly of nitrogen, oxygen, carbon dioxide, and water vapor. In order to free nitrogen from the other constituents, air was bubbled, first through a solution of potash, which detains the carbon dioxide, then through concentrated sulphuric acid, which is a trap for water vapor, and lastly over red hot copper, which is a famous oxygen "grabber," after which the nitrogen emerged into the globe prepared for it, supposably pure. Red hot iron filings, or ferrous hydrate, may be substituted for hot copper; but whatever means were employed to separate the atmospheric nitrogen from its fellow constituents, Rayleigh found that the weight of nitrogen going into the globe, in each experiment, remained fairly and satisfactorily constant.

So far, so good; but when nitrogen from ammonium nitrate, nitric oxide, or any other compound, was conducted into the glass globe, it weighed eleven milligrammes less than when it contained atmospheric nitrogen. Eleven milligrammes is not a great weight, about that of a pin's head, but it was quite sufficient to disturb the equilibrium of both his lordship's balances and—mind. It was not, however, until a year ago, after two years' work, that the result stood sharply and unmistakably out that "chemical" and "atmospheric" nitrogen differed in weight.

Now, admitting this difference to be established, an obvious explanation would be the presence of some impurity in the gas from either source. An elaborate investigation proved, so far as chemical science can prove, that the nitrogen derived from chemical sources contained nothing which could account for the discrepancy, and Rayleigh was thus obliged to ask himself the further question, "What evidence have we that atmospheric nitrogen is one substance, pure simple?" On referring back, great was his surprise to find that the question had been put, just as sharply and decisively, one hundred years ago, by that shrewd Scotchman, Henry Cavendish, who so advanced the science of his time; and furthermore, that no work had been done since. Cavendish not only asked the question, but endeavored to answer it by the following experiment:

A mixture of air and oxygen, together with a small piece of potash, was passed into a U tube inverted over mercury. Through the air so inclosed, a series of electric sparks passed continuously for days, and even weeks. Under these circumstances nitrogen unites with oxygen to form nitrous acid, which is converted by the potash into solid potassium nitrite. The mercury rises in the tube to take the place of the disappearing oxygen and nitrogen; but Cavendish found that, even after weeks of continuous sparking, a small bubble of gas remained unabsorbed. That bubble, if Cavendish had only known it, was argon. Needless to say Rayleigh repeated the experiment. He then transferred the gas so obtained to a vacuum tube, and observed the spectrum. It was different from anything else in the universe; and lo, argon was discovered!

Cavendish cannot be awarded the honor of the discovery, because with his crude apparatus he could not feel certain that his residual bubble was genuine.

He merely concludes that "if there is any part of the phlogisticated air (nitrogen) of our atmosphere which differs from the rest, and cannot be reduced to nitrous acid, we may safely conclude that it is not more than $\frac{1}{120}$ of the whole."

In the method of Cavendish, as improved by Rayleigh, the mixed gases, air and oxygen, are fed into an immense glass flask half filled with caustic potash. Instead of the small electric spark he uses an electric arc (from a current potential of 2,400 volts), between thick platinum terminals, situated about half an inch above the alkali. The mixed gases are absorbed at the rate of seven quarts an hour. The argon gradually accumulates, and when it is desired to stop operations, oxygen only is fed into the flask. At the end, when the nitrogen is completely absorbed, the flame suddenly changes to a bright blue color. The excess of oxygen is then absorbed by potassium pyrogallate, so well known in photography, and the argon remains free from impurity.

Soon after isolating argon, Rayleigh took Professor Ramsay into his confidence, who soon devised a chemical method which is equal, if not superior, to the foregoing. This method depends on the peculiar fact that nitrogen, so inert with most substances, will unite quite readily with magnesium to form a solid nitride. The apparatus consists of a closed system, containing soda, sulphuric acid, phosphorous pentoxide, red-hot copper and red-hot magnesium, through which the air wanders in a closed circuit until deprived of carbon dioxide, water, oxygen and nitrogen. The residue is pure argon. So far as the yield is concerned, the second method is preferable to the first, giving as much argon in eight hours as can be obtained in fourteen hours by the oxygen method.

Ramsay's method has lately been much improved by M. Guntz, who passes atmospheric "nitrogen" over several iron boats containing electrolytic lithium, which absorbs nitrogen completely at a low temperature and collects the argon over mercury at the exit end of the apparatus.

Still another method is to pass atmospheric "nitrogen" into a large flask in which there is an electric arc formed between magnesium terminals. The magnesium burns the nitrogen into solid magnesium nitride, and the argon remains.

Now, what is argon? It is a colorless, odorless gas, existing in the atmosphere to such an extent that, in a room containing 6,000 cubic feet, we should have about 50 cubic feet of argon.

Since we have thus a practically unlimited supply, can we put it to any economic use? Not unless we can make it enter into combination with some other element; and happily enough, in spite of its name—"lazy"—the famous French chemist, M. Berthelot, by means of the silent electric discharge, has succeeded in making it enter into a combination in which mercury, argon and condensation products of benzine are concerned. In addition, argon has lately been found with helium in combination with meteoric iron.

Should Berthelot's compound turn out sufficiently stable to be isolated, there is a probability that it may serve as a gate through which our element may enter into innumerable other combinations possessing properties which may or may not be useful to the race.

The very discovery of argon, however, stands as a warning to those who would teach us that science is bankrupt.

R. K. DUNCAN.

ELECTRICAL ITEMS WORTH REMEMBERING.

Dropping a steel magnet, or vibrating it in other ways, diminishes its magnetism.

It is said that steel containing 12 per cent of manganese cannot be magnetized.

Flames and currents of very hot air are good conductors of electricity. An electrified body, placed near a flame, soon loses its charge.

In charging a secondary battery, the charging electro-motive force should not exceed the electro-motive force of the battery more than 5 per cent.

Lightning has an electro-motive force of 3,500,000 volts and a current of 14,000,000 amperes. The duration of the discharge of lightning is $\frac{1}{30000}$ of a second.

The resistance of copper rises about 0·21 per cent for each degree Fah., or about 0·38 for each degree Cent.

A lightning rod is the seat of a continuous current, so long as the earth at its base and the air at its apex are of different potentials.

The rate of transmission on Atlantic cables is eighteen words of five letters each per minute. With the "duplex" this rate of transmssion is nearly doubled.

The effect of age and of strong currents on German silver is to render it brittle. A similar change takes place in an alloy of gold and silver.

To obtain the number of turns of wire in an electro-magnet, multiply the thickness of the coils by the length, and divide by the diameter of the wire squared.

A test for the porosity of porous cells consists in filling the cell with clean water and taking the per cent of leakage. The correct amount of leakage is 15 per cent in 24 hours.

If the air had been as good a conductor of electricity as copper, says Professor Alfred Daniell, we would probably never have known anything about electricity, for our attention would never have been directed to any electrical phenomena.

A perfect vacuum is a perfect insulator. It is possible to exhaust a tube so perfectly that no electric machine can send a spark through the vacuous space, even when the space is only one centimeter.

For resistance coils, for moderately heavy currents, hoop iron, bent into zigzag shape, answers very well. One yard of hoop iron, ½ inch wide and 1-32 inch thick, measures about 1-100 of an ohm; consequently, 100 yards will be required to measure an ohm.

The voltage of a secondary battery must always be equal to or slightly in excess of the voltage of the lamp to be burned. For example, a 20 volt lamp will require 10 secondary cells, but 10 cells will supply more than 20 lamps.

Compression of air increases its dielectric strength. Cailletet found that dry air compressed to a pressure of 40 or 50 atmospheres resisted the passage through it of a spark from a powerful induction coil, while the discharge points were only 0·05 centimeter apart.

An accumulator with 17 plates, 10 by 12 inches, is

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reckoned, in horse power hours, equal to about one horse power hour. Taking this as a basis, it will require 6 cells for one horse power for 6 hours, or 30 cells for 5 horse power for the same length of time.

To obtain the length of wire on an electro-magnet, add the thickness of the coils to the diameter of the core outside of the insulation, multiply by 3.14, again by the length, and again by the thickness of the coils, and divide by the diameter of the wire squared.

Blotting paper, saturated with a solution of iodide potassium to which a little starch paste has been added, forms a chemical test paper for testing weak currents. When the paper (slightly damp) is placed between the terminals of a battery, a blue stain appears at the anode, or wire connected with the carbon or positive pole of the battery.

THE BIOLOGICAL LABORATORY AT COLD SPRING HARBOR, LONG ISLAND, N. Y.

The visitors who find their way into the bright, airy laboratory at Cold Spring Harbor, and are shown about by Dr. Conn, the director, can hardly fail of getting a pleasant impression of the place. But the full charm and value of the work done here and the esprit de corps of instructors and students can only be realized by one who has studied here for a summer. And most fortunate of all the students who have ever attended the sessions of the school are those who have come this year, for the comforts of living have never before been so ample.

The foundation of the school was due primarily to the energy of Professor Franklin W. Hooper, secretary of the Brooklyn Institute, under the auspices of which it was established and is still maintained. Prominent on its board of managers from the first have been the Hon. Eugene G. Blackford, Mr. John D. Jones and Dr. O. L. Jones, and their generous gifts contributed largely to its original equipment.

For the first three summers the work was carried on at the Hatchery of the New York Fish Commission, but under much inconvenience; the necessarily limited number of students found lodgings where they could in the vicinity. But with a director so able and enthusiastic as Dr. H. W. Conn, of Wesleyan University, who took charge of the work the second summer, the school was bound to grow. In 1892, Mr. John D. Jones, already mentioned as among the first benefactors, was instrumental in the incorporation of an association called the Wawepax Society, and it is to this organization that the school owes its present ample quarters.

The laboratory which they built, after Dr. Conn's plans, was occupied last summer. This year they have put at the disposal of the students two comfortable buildings for dormitories. The one for ladies, which contains a dining room and reading room for the whole party, is especially pleasant. The buildings have been comfortably furnished by the Brooklyn Institute. Together with the lecture hall and Professor Conn's home, also given by the Wawepax Society, they form a picturesque group most conveniently situated with reference to each other.

Their location is delightful, for they stand on the hillside sloping to the head of Cold Spring Harbor, with wooded hills behind them and across the inlet, while in the distance stretches the Sound. New York is only thirty miles away, but the quiet of the place could hardly be more if we were in the heart of a desert.

Not only do we hear no market wagons, fog horns, trolley gongs or locomotive whistles, but not even a town clock disturbs us. The rest to tired nerves is almost equal in value to the benefit to be derived from the work; to some people it may mean quite as much.

The laboratory deserves fuller description. It is a pretty building, 72 feet long by 36 feet wide, finished exteriorly with shingles and interiorly with polished Georgia pine; a large brownstone fireplace partly fills one side of the main room. There are wide and high windows close together on every side, so that light and air are as abundant as possible.

Through the warm July days it has not been uncomfortable. Broad working tables fitted with drawers stand in range of the windows along the sides of the room in sufficient number to accommodate about forty students. There are six rooms fitted up for private laboratories for the professors and investigators.

Along the center of the main room aquaria are placed, through which fresh or sea water may be made to pass at will by turning a stopcock in the pipes above. Nothing in the life here is more entertaining than to watch that of the forms which for the time inhabit these aquaria. To-day we may find the sides of one beset by star fishes, little and big, their ambulacral feet clinging so fast that they will lose some rather than let go, if you attempt to move them. Below them hermit crabs are looking out from snail shells of varying sizes; a spider crab is dining off her own eggs, which she picks out with her long claws, while another is feasting upon a dead brother.

Scollops are popping up and down in jolly fashion, and great clumsy whelks have their broad yellow feet spread firmly upon the side of the aquarium where they are companions in exile.

In the next one, perhaps, there is a mass of squids' eggs in long, airy looking sacs, from which, one by one, minute independent squids now begin to swim into sight. Farther on we may see botanical specimens: delicate green or red algae, and beside them in the next aquarium is a pond lily plant, root, leaves and fruit all in sight. Yesterday one aquarium was full of beautiful sponges, of which several varieties are found in the Sound. To-morrow some of these forms that we have watched with so much interest will give place to others perhaps even more curious.

These specimens are, for the most part, brought in by dredging parties who go out in the naphtha launch belonging to the laboratory. It is run by a man who knows just where to "let down the net" for everything these waters yield. The boat is swift and fairly comfortable, and the excursions upon it are among the most delightful and profitable features of the life here.

The working day begins at nine o'clock in the morning, when Prof. Fernald, of the State College, Pennsylvania, gives a lecture in the course in zoology and Prof. Conn gives one to advanced students in his course in embryology. These last an hour, and then all pass to their places at the tables in the laboratory. Each student is provided with the instruments he needs for dissection, and with a microscope, if he has not brought his own. The morning is all too short for the work that is to be done—the verification of the lectures or the study of some forms kindred to those presented by the instructors.

Let us go about the room during one of these experimental hours. We may find some students watching the development of newly fertilized eggs of oysters or squids. Here a young man is working out the nervous system of a species of worm—no easy task. We notice that a group is studying the lobster. They are at various stages of progress; one lady is making careful drawings of each of the appendages, while another is already tracing the digestive tract, and a third is finding the chain of nerve ganglia and their connections. The instructors are going about from place to place, adjusting a lens for one student, directing a cross section here, advising a better mode of procedure, helping or suggesting, as the case may be, but always attentive and unflagging in interest.

Many students are taking two courses, and in the afternoon two more lectures are given; one in the course in botany, by Prof. Johnson, of Michigan University, the other by Prof. Conn, on bacteriology. The afternoon laboratory work is largely botanical. Here is an enthusiast who has scarcely been seen since the day of his arrival without a quantity of mushrooms about him; he draws them, makes water color sketches of them, dries them, labels them, calls your attention to their beauties and peculiarities—does everything but eat them. Across the room we find several students are making slides. Their skill and success is evident if they invite you to look through their microscopes, for you find they have captured sea anemones and hydroids with tentacles spread, and the delicate forms have all the interest of a living specimen, save that they are motionless.

The students may be divided into three general classes: First, investigators who are working toward Ph.D. degrees in some college or university; second, teachers of science who have come to learn better methods, to get laboratory practice and to find out the latest opinions on unsettled questions in science; for example, whether both botanists and zoologists are still claiming volvox. The third class is composed of the youngest students, who are still undergraduates in college, or are supplementing the work which they have just completed there, preparatory to teaching or other practical science work. Most of these are from Wesleyan University.

But whatever the attainments or objects of all these students, there is no discounting the zeal and enthusiasm with which they study. The generous willingness to show what they find out so characteristic of the great scientists prevails here. Not a day passes but we see as interesting objects through other microscopes as our own.

The later parts of the day are devoted more or less to bathing, boating on the harbor or one of the ponds close by, or to rambles in the tempting woods. The wheelmen are among us, of course, and come into breakfast or dinner with cyclometer records that fill us with amazement, but which they assure us are quite within the bounds of moderation. Sometimes we have an evening of college songs, jolly, rollicking and care-dispelling as nothing else can be.

Once a week an evening lecture, semi-popular in its character, is given, and to this residents and summer dwellers or visitors at Cold Spring Harbor are invited. Prof. Conn opened the course with a suggestive lecture on "Evolution." Prof. Fernald followed with a charming account of "Three Months in the Bahamas."

This week we have had an illustrated lecture on our common wild flowers by Mr. Van Brunt, of New York. The beautiful colored photographs which he shows are his own and his wife's work, and very difficult to make, he says, "because the flowers are so full of life and move so much." But they have succeeded in getting pictures as poetic as they are true.

Reference has already been made to Prof. Conn's course of lectures on bacteriology. His investigations in this field, which have put him among the foremost bacteriologists, are carried on at the laboratory during the summer. Some ninety colonies of bacteria are under examination, the preparation of their culture media, their sterilization and that of the utensils used about them, the daily record of growth, multiplication, etc.—all this work is carried on under Prof. Conn's direction by his students and assistants. In time these ninety colonies will be differentiated and their value or deleterious effects will be tested.

Besides this work, the cultivation of Prof. Conn's famous "Bacillus Number 41" is carried on here, and from here it is mailed to creameries far and near where it has been adopted. The fact is that the application of this bacillus to butter making is revolutionizing the business, for not only does its introduction into the cream give a superior flavor to the butter, but it also makes it keep better. Already, some Iowa creameries have made between $20,000 and $30,000 by its use, for the reason that whereas they were formerly not able to get their butter into the seaboard markets soon enough to command the highest price, now they do, for they can sell their product for fresh butter.

This practical outcome of investigation with the bacteria which thrive in milk can hardly fail to act as a stimulus to some students at the laboratory to persevere in their patience-taxing study, and it is not unlikely that the world may some day see important results from their work. To the students least ambitious for renown or reward of any sort there is a stimulus in the thought of Mr. Benjamin Kidd that "in our time biology has been raised from a mere record of isolated facts to a majestic story of orderly progress."

Cold Spring Harbor, L. I., July 27, 1895. A. D.

A Great Gas Holder.

The recent completion of the largest gas holder in America, in connection with the largest metal tank ever constructed, is an event in the history of the gas industry worthy of notice.

The holder in question was built by Messrs. R. D. Wood & Company, of Philadelphia, for the New York and East River Gas Company, at their works in Ravenswood, Long Island City, nearly opposite Sixty-fourth Street, New York City. It has a capacity of five million cubic feet. It is the first holder of importance built in this country with the inner lift rising above the top of the guide frame when fully inflated.

The general dimensions of the holder are as follows:

First or inner lift	179 ft. 0 in.	diameter by	48 ft. 6 in.	deep.
Second lift	182 ft. 0 in.	"	"	49 ft. 0 in.	"
Third lift	184 ft. 6 in.	"	"	48 ft. 6 in.	"
Fourth or outer lift	187 ft. 0 in.	"	"	49 ft. 2 in.	"
Steel tank	190 ft. 0 in.	"	"	49 ft. 6 in.	"

Guide frame; 24 standards, 148 feet high; 5 tiers of latticed girders.

The tank rests upon a concrete foundation, the space under the bottom plates being filled with a cement grouting run through holes in the plates after the bottom was lowered upon the foundation.

The top of the tank shell is stiffened by a horizontal plate girder, 48 inches wide, which serves as a walk around the tank, extension plates being placed back of each standard to permit passage.

When the holder is fully inflated, the crown is over 40 feet above the top girder and is reached by means of a chain ladder kept taut by a weight on its lower end, working in guides. When the holder is filled with gas, the crown is 240 feet above the level of the ground.

The largest holder of the world is that built by Messrs. Clayton & Sons for the South Metropolitan Company, at East Greenwich, London, and which possesses the enormous capacity of 12,200,000 cubic feet. It consists of six lifts, of the following dimensions:

Inner lift	287 ft. 6 in.	by	31 ft.	deep.
Second lift	290 "	"	32 "	"
Third lift	292 " 6 "	"	32 "	"
Fourth lift	295 "	"	31 "	6 in.	deep.
Fifth lift	297 " 6 "	"	31 "	3 "	"
Bottom lift	300 "	"	31		"

The depth of the masonry tank is 34 feet, 13 feet of which is below ground and 21 feet above.

Curves of Least Resistance.

A novel method of determining the curves of least resistance in water and air was recently employed at Newport News, and was described in the American Engineer of July by M. Moulton, S.B. The idea was to make the water and air themselves shape the model, and accordingly rectangular blocks of ice were towed in the water, and the alterations in their shape and in the pull necessary to keep them moving at a certain speed carefully noted. The method proved quite successful, and the experiments will be continued until complete data are obtained. Wax was the material used for the models moving in air, and the air currents were heated sufficiently to gradually melt the wax.

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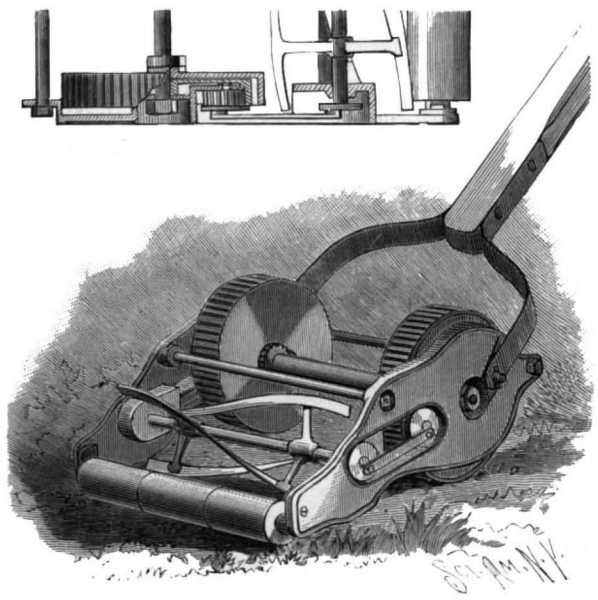
AN IMPROVED LAWN MOWER.

In the lawn mower shown in the illustration the knives are driven by crank and pitman connection with the ground wheels, the driving mechanism being located entirely within the outer face of the frame, and there being no projections to collect the cut grass. The improvement has been patented by Mr. Edward Ingleton, of Pottstown, Pa. The axle carrying the ground wheels is journaled in depressions of the side or cheek pieces of the frame, the wheels being cupped on their outer faces. The wheels are loosely mounted,



INGLETON'S LAWN MOWER.

and ratchet wheels on the axle adjacent to the hubs are adapted for engagement by a dog on each wheel, the dogs turning the axle when the mower is pushed ahead and slipping over the ratchets when the mower is drawn backward, the cutting mechanism being then inoperative. In each of the side pieces is a horizontal depression or well having near its center an opening. The shaft of the cutter is journaled in the inner walls of the wells, and on the shaft are spiders which carry the spiral cutting knives, extending from the inner face of one side piece to the inner face of the other side piece, the knives being thus protected from obstacles at the sides of the machine and adapted to cut a swath of nearly its full width. An internally toothed gear on each end of the axle, within the flanged portion of each ground wheel, as shown in the small sectional view, engages a pinion on a short spud axle, and each pinion has a crank disk connected by a pitman with a crank disk on each outer end of the knife shaft, the entire driving mechanism being thus inclosed and protected, permitting the machine to be run very close to trees, flower beds, etc. At the lower forward portion of the frame are rollers, and the handle is suitably pivoted to the rear portions of the side pieces.

THE "HOME TRAINER" FOR TESTING BICYCLES.

The delivery in perfect order of bicycles purchased by customers is, in the cycle trade, an occurrence that is unfortunately too rare. All cyclists who read these lines will recall the disagreeable surprises that a badly

THE "HOME TRAINER" FOR TESTING BICYCLES.

keyed crank, too taut a chain, etc., has caused them upon unpacking a machine shipped from the factory. It is because a bicycle, which seems at first sight a very simple machine, is in reality very complex. Even if it is put together with extreme care, there is no guarantee, before it has been tried, that all the parts of it are in perfect unison. The union of excellent pieces may form a detestable machine.

Now the testing of a bicycle at the factory presents inconveniences and difficulties. One of the first is the soiling of the pneumatic tires, which the customers like to receive with an aspect of absolute newness and which a trial in a factory begrimes beyond remedy. On another hand, one of the principal difficulties of such trials consists in the want of sufficient space, especially at Paris, where considerations of rent have a genuine importance and where a hall thirty or forty yards in length by twenty in width devoted solely to the running of bicycles before sale would constitute a luxury.

In the manufacture of the Rochet bicycles, we have a happy application to the trial of machines of what is known as the "Home Trainer," an apparatus well known in cycling and that permits the bicyclist to train himself at home, even in his bed room.

This apparatus, of which our figure gives a very exact representation, is formed of three large wooden cylinders, hollow in the center and rolling with slight friction upon the extremities of their central axis in a wooden frame. Above the cylinders there is a platform that permits the tester to mount upon the apparatus in order to place the machine, which a support holds in equilibrium at the moment of the starting or stoppage of the bicycle. After the operator has given the pedals a few kicks, he lets go of the supporting bar and rolls in place, keeping the same equilibrium as in the ordinary use of the bicycle.

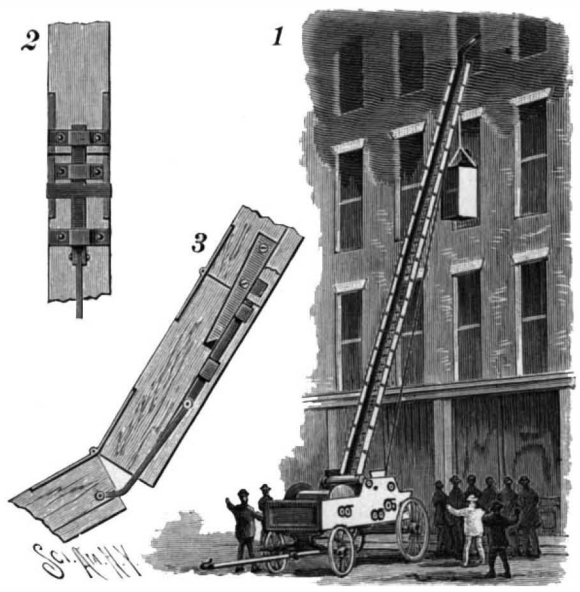
It will be remarked that the driving wheel of the bicycle is here at the same time the motor of the three cylinders. It moves by friction the two upon which it rests, and, through the endless chain running over the toothed wheels seen at the bottom of the figure, likewise actuates the front cylinder and consequently carries along the steering wheel of the bicycle.

All the parts of the machine therefore operate as they would do in the hands of the purchaser. The tester rides it for about five minutes. Has one of the wheels too much play? If so, he remarks it at once and sends the machine back to the mounting shop. He sees whether the handle bar is well screwed in the head, and whether the pedal bracket, the pedals, the keys and the nuts need tightening, etc. Sometimes an air chamber pinched between the felly and the pneumatic tire bursts as soon as the machine begins to roll. Such an accident, happening on the first day of using the machine, sometimes at two or three hundred miles from the place of manufacture, would prove very embarrassing to the purchaser, besides making him very angry.

We would recommend the use of this machine, then, to all bicycle manufacturers.—La Nature.

A HOSE TOWER AND FIRE ESCAPE.

The illustration represents a fire department apparatus designed to serve as a hose tower, fire escape, geyser, and truck, and which has a collapsible ladder adapted to be coiled upon the truck or readily extended to any necessary height, the pitch of its inclination being easily regulated. The improvement has been patented by Mr. Francis M. Painter, of No. 609 Pine Street, St. Paul, Minn. Fig. 1 represents the apparatus with the ladder extended to the upper floor of a building, Fig. 2 being a bottom plan view showing the connection between the ladder sections, and Fig. 3 representing the sections partially opened. Mounted transversely on the truck is a drum whose body is faceted to facilitate folding on it the ladder sections, and the drum is on a shaft with end cog wheels engaging other cog wheels with squared shafts, to which a wrench is applied to turn the drum to wind up the ladder, pawls preventing the shaft and drum from turning back. To raise the ladder and unwind it from the drum, cables are secured to and adapted to be wound on the drum with the ladder and unwound as the ladder is raised. These cables extend over guide pulleys and are secured to a drum whose shaft is connected by gears with a squared shaft to receive a winding crank. The lower end of the ladder is hinged to the drum at one edge of one of its facets, the several sections of the ladder being hinged together on the inner side, as shown in Fig. 3, to enable them to fold compactly on the drum, and each ladder section having at one end and on each rail an arm overlapping the rail of the adjacent section and fitting in a side socket therein. On the side of one of the rails opposite the arm is a bolt sliding in keepers, as shown in Fig. 2, the bolts being automatically moved when the ladder is raised or lowered, each bolt being connected by a rod to the next ladder section below. A guide comprising opposite end frames and auxiliary mechanism straightens and adjusts the ladder as it is raised, and at the top of the ladder is an adjustable cross bar carrying the several nozzles and hose, the nozzles being held in place and the hose held to the ladder by keepers. When the ladder is raised, the cross bar may be adjusted so that the nozzles will point as desired, and the hose are provided with couplings at frequent intervals, as many sections of hose as it is desired to use being connected with the engine supply pipe. The ladder is also provided with a speaking tube made up in sections and with a gong near each end. A car for use in rescuing people from a building, and adapted to be raised or lowered opposite the windows, is suspended from a guide pulley at the top of the ladder, the cable passing down over a drum

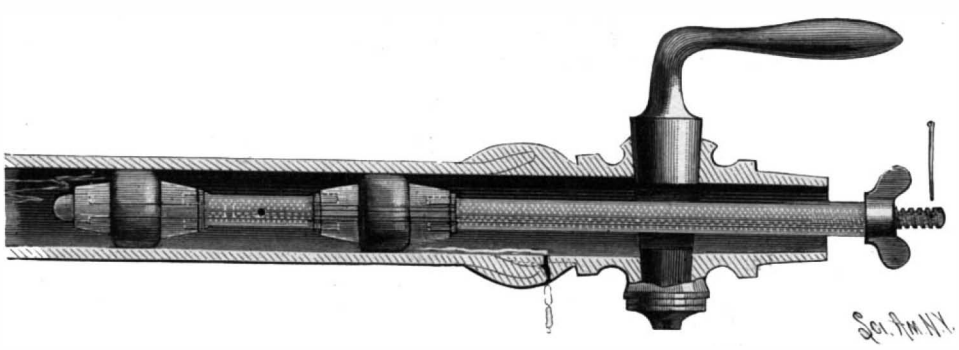


PAINTER'S HOSE TOWER AND FIRE ESCAPE.

journaled in the truck frame, the car being raised or lowered by winding or unwinding the cable by turning the drum. The car may also be used as a platform on which the firemen may stand, and in the front part of the truck frame is a hose reel on which extra hose may be wound.

A TOOL FOR CLOSING WATER PIPES.

When it is desired to close pipes where a stop cock cannot be used to shut off the water, in making repairs, the tool shown in the illustration is designed to facilitate the work. It has been patented by Mr. John J. Meyer, of No. 22 East One Hundred and Thirty-fourth Street, New York City. The hollow stem of the tool has at one end a head and its opposite end is screw threaded, and adjacent to the head are collars clamping between them an expansible washer. One of the outer collars is connected by a sleeve with inner collars clamping a second washer, the inside collar being engaged by a tube surrounding the stem, and there being on the outer end of the tube a wing nut engaging the screw-threaded outer end of the stem. To prevent the stem from rotating while the nut is being turned a pin may be passed through an opening in the outer end of the stem, and an opening in the sleeve connecting the washer clamping collars communicates with an opening into the bore of the stem, to allow the escape of any water which may leak past the first washer. When a pipe is cut or broken off, the tool is quickly inserted in its broken end, allowing only one gush of water to escape, when a few turns upon the wing nut force the washers into tight engagement with the inner walls of the pipe. This tool may also be used



MEYER'S PIPE CLOSER.

for closing gas pipes. To remove the tool without considerable loss of water, a stop cock of the ordinary construction may be employed, and its casing slid over the tool before or after its introduction into the pipe, a suitable connection being made between the casing of the stop cock and the pipe.

The New Graving Dock at Southampton.

The ceremonies of opening the new graving dock at Southampton, England, took place August 3. The Prince of Wales and great crowds celebrated the event. It is the largest single graving dock in the world, being 750 feet in length on the floor and is so constructed that it could be made 250 feet longer. The entrance has a width of 87½ feet at the sill level and 91 feet at cope, the dock width being 112½ feet.

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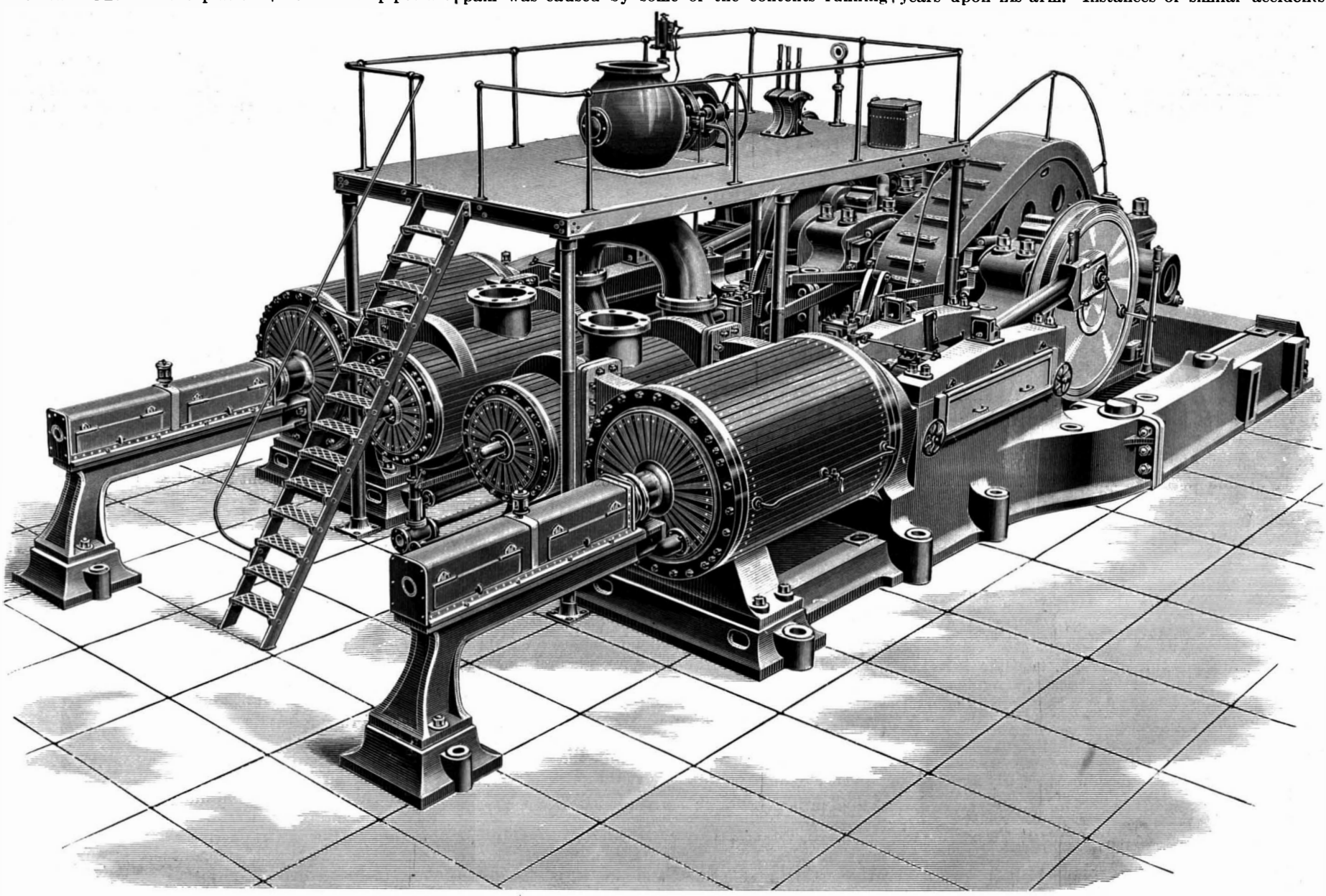
IMPROVED COMPOUND REVERSING ENGINES.

In recent numbers of Engineering an illustrated description has appeared of the extensive works of the Glasgow Iron and Steel Company's works at Wishaw, which are known throughout the world for the excellence of their iron productions. Of plates alone, some thirteen hundred tons are turned out weekly. We herewith give an engraving of the engines pertaining to the plate rolling mill of the establishment, for which and the following particulars we are indebted to Engineering:

These engines, massive in design, were constructed by Messrs. Duncan Stewart & Company, Glasgow. The cylinders are 52 inches in diameter by 60 inches stroke, and the engines are geared in the ratio of about 2 to 1. The large spur and pinion wheels are made of steel, and have straight teeth covered over with a neat, serviceable, plated hood fitted with steps and handrail. The engines are fitted with piston valves and reversing straight-link motion. The eccentric rods have adjustable brasses for taking up the wear. The valve motion is reversed by a steam cylinder, with regulating oil pressure cylinder of the most modern type, having steam and handling gear worked from the platform. The engines are also fitted with a reservoir oil tank fixed on the platform, from which pipes are conducted to each of the main shaft bearings. Steam can also be turned into the oil pipes to clean them out, should they get choked at any time. Sight-feed lubricators are also provided. The engine bed plates are strong and massive, having a large base for fixing down to the foundations, which are of concrete. The main stop valve is fitted with a screw-stop by-pass valve, so that the engines can be started or stopped without opening the large valve. Disengaging gear is fitted to the main shaft, so that the clutches can be thrown out when required.



IMPROVED COMPOUND REVERSING ENGINES.

Some of the Trials of Druggists.

The California Druggist says: The life of the pharmacist is not always free from adventure nor his path from thorns, and even though he may gather in seven hundred per cent profit on an emetic or a dose of salts, there are contingencies in his business that the average merchant does not share. From the time when the druggist's boy burns holes in his shirt with acid, charging soda fountain, to the haling of him before the county judge, as proprietor, for repeating a "prescription" once too often, he must ever be on his guard against calamity.

The time was—we know a few old fellows who remember—when the long green vial was in common use, and when the thin glass was fain to crush in the process of corking, entailing painful consequences to the fingers; when the older clerk would plan disagreeable surprises for the boy, in the educational line, utilizing for the purpose his superior knowledge of drugs like cowhage, hellebore or capsicum pods, or setting him to work on a batch of mercurial ointment, supplying him with the freshest of lard and highly enjoying his perspiring efforts to incorporate the coy and elusive mercury.

However, the mill has taken the place of the mortar, and the clerk no longer makes mercurial ointment, nor powders crude drugs, and he now charges the soda fountain from a cylinder and saves his shirts. Occasionally the accidents of the druggist partake of the comic, as when a young friend of ours, just ready one Sunday evening to go out with his best girl, was called upon to prepare a pint of "black oil" and, adding the acid sulph. all at once with a vigorous shake to the other ingredients, was transformed instantaneously from a well dressed and scented beau to a lugubrious specimen of disappointed hope and ill-smelling clothes. The spot on the ceiling long showed the center shot of the prescription.

A large bottle of stronger ammonia, in the hands of a clerk who was on a step ladder, having been broken by an unlucky tap against a step, no little trouble and pain was caused by some of the contents running down the front of him, beneath his loose overalls. It was no fun for the young man, though his companions took it that way. This was in a wholesale store, and a somewhat similar accident befell another of the boys, again by the step ladder route. In taking down a bottle of nitro-muriatic acid, some of the acid was spilled directly on the top of his head in some unaccountable way, and such a mass of capillary stickiness resulted! The near-by water faucet and the ready resources of the chemist prevented very serious consequences. Not so easily, though, did the packer escape, when a gutta percha bottle of hydrofluoric acid, which he was pressing into a small space in a box of goods, threw out its stopper, sending a small quantity of the acid into his eye. The incident furnished another instance of the value of the gold-medal chemist, whose promptness and skill saved the victim from blindness. A still more serious trouble came upon a poor fellow we knew whose position as under-porter obliged him to repack Paris green. Disregarding instructions as to protecting his nose and mouth thoroughly from the dust, he inhaled enough of the poison to render him a physical wreck. For a long time he was under pension from his employers, till death came to his relief.

Recently we were shown a rough hole in a drug store shelf, made by the top of a bottle of peroxide of hydrogen which exploded beneath and which would just as readily have gone through the druggist's head had it been in the way. During the same week we saw in another store the effects of an explosion of a tube of nitrite amyl, where thousands of particles of glass were blown into the near-by woodwork. The pharmacist was almost directly in front of and near the tube when it "went off," but most fortunately for his countenance, not to say eyes, he had moved his head to one side at the moment of explosion—a close call.

Probably sulphuric acid has left its mark in the form of scars upon more druggists than has any other article in his line. We once knew a clerk in an Eastern city who broke in handling it a carboy of the acid, and was pretty thoroughly saturated with the fluid. It was sheer good luck in his case that the back door opened upon the Erie Canal, into which he jumped instanter, saving his flesh though losing his trousers. The same establishment furnished another victim a little later, who in pouring acid from the carboy into a pitcher (the old way), splashed his face with a little acid, which struck the corner of his eye. The pain caused him to quickly jerk the carboy to an upright position, which movement threw out an additional quantity of the caustic fluid upon his arm, which was bared to the shoulder. This accident left our friend with a bad scar on his face and caused running sores lasting many years upon his arm. Instances of similar accidents might be multiplied indefinitely, and almost every old drug store could furnish reminiscences of startling explosions and sudden combustions more or less serious in their effects, but which the progress of pharmaceutical knowledge is rendering less and less frequent.

Seasoned Railway Cars.

The Railway Master Mechanic says: The quality of the "well seasoned" wood ordinarily employed in freight car construction was nicely demonstrated recently by the reweighing of some cars which were built by a carbuilding concern nearly two years ago, and which could not be accepted by the road for whom they were built because of its financial straits. When completed they were weighed and the weight stenciled on each car. When disposed of a few months ago they were again weighed for some reason and each car was between 1,000 and 2,000 lb. lighter than when placed on the side track. The drying out process was, we trust, complete. This incident provides an argument in favor of a standard freight car, or at least standard dimensions for all the principal timbers of a car, for then the roads could insist on drier lumber being used, while as things are at present no builder can purchase in advance a stock of material which can be utilized without excessive waste, and he has, therefore, to obtain the best seasoned lumber available at the time the contract is made.

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PHOTOGRAPHIC PRINTING BY MACHINERY.

(Continued from first page.)

up from the bottom of this compartment is a submerged roll. Running down vertically in the center of the sides of each compartment is a slotted way to guide the axes of small, loose, brass rollers which carry the paper to the bottom and freely revolve as the paper moves forward.

Over the division of each compartment is an actuating roll, all being geared to a worm screw running along the top edge of the long tank its entire distance, which gives every roll the same speed.

The paper, after passing over the submerged roll (Fig. 4) and down again, thence up out of the tank over the roll between the first and second tanks and down into the fresh ferrous oxalate developer in this tank, shows the images half developed out. The electric lamps overhead are a non-actinic red.

Coming out of the second tank, the images are fully developed, thence the paper passes on into the third vat, containing dilute acetic acid, which dissolves out all of the iron left in the paper from the developer, and acts as a check to further development, thence in the next vat the paper is washed with water; next it passes into a fixing vat containing a solution of hyposulphite of soda, is again washed in the following tank, then it passes into a vat of alum water, which hardens the film, and finally goes through two or three vats of water, receiving a final spraying, as shown in Fig. 4.

From the last spraying it is led onto an endless canvas carrier into a long inclosed chamber filled with a current of warm air, heated by a gas furnace noticed near this end. At the end of this heated chamber the paper comes out perfectly dry, and is rolled up with the pictures all on it. When the run is complete the roll of pictures is unwound, they are cut off to the respective sizes desired, and mounted in the usual way.

While the paper is traveling over the several rolls, attendants with sponges sponge off any dirt or light material which may cling to the surface as it is drawn up from the solutions. At the further end of the trough the paper with the pictures upon it may be seen traveling upward.

A very curious anomaly is the mixture of white and red light in the developing room. The two lamps over the developer and roll where it is unwound are red, while all the others are white. There is just enough red to neutralize the white at the beginning. Thus it makes the brightest dark room we call to mind, and was a surprise in the art of photographic manipulations.

There are twenty-seven rollers on the large box tank, and the tank itself is not far from one hundred feet in length. The paper travels through the tanks at the rate of ten feet per minute, and it is possible to arrange enough cabinet negatives in the exposing machine to expose 245 cabinet pictures in a minute. But an ordinary day's work of ten hours yields 157,000 cabinet pictures.

We are informed this is the only machine of its kind in this country, and but one other is in Germany. The work which we saw made by it was very satisfactory and uniform.

In dealing with such large quantities of material, uniformity appears to be easily attained, and the applicability of a similar machine, properly modified to

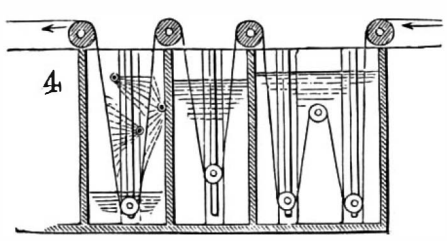

Fig. 4.—THE DEVELOPER TANK.

the development of negatives and films having had reasonably uniform shutter exposures, may be a possible outcome of this invention.

For the foregoing particulars we are indebted to the Automatic Photograph Company, No. 25 West Twenty-fourth Street, this city, through whose courtesy we were permitted to witness all the details of this remarkable and interesting apparatus and plant.

The Use of Naphtha.

The greatest care should be observed in the use of naphtha, which while a most valuable agent to clean delicate laces, light silks and ribbons, is a very dangerous liquid. It is so extremely volatile that ignition will take place even when it is removed by the distance across a room from a light, and it should never be used except in the daytime. Articles cleansed by this means should be promptly and thoroughly aired; it is a good plan, the Commercial Bulletin suggests, when the weather permits, to do the cleaning out of doors, leaving even then the things cleansed outside for a longer airing.

The need for this was recently emphasized to an uptown woman, who washed a number of gloves, some laces and ribbons, and, fearing to leave them around the room, as she was called away before they were aired, bundled them into a box, which she shut up in a trunk in a closet.

Later, she sent a maid to get them out, who took a lighted candle to the closet for the search. When the trunk was opened, a slight explosion followed almost immediately. Enough of the gas from the naphtha had been generated and held in the confined space to ignite as the candle flame approached. No serious results followed, fortunately, but the warning remains.

Last of the Philadelphia Cable Cars.

A few days more will witness the ending of the cable system as a means of passenger transportation in Philadelphia. Within a week every remaining cable car on the Market Street main line, the last link in the cable system, will be displaced by trolleys. The passing of the cable cars marks a step in the progress of street railway facilities in Philadelphia. When the system was introduced, it was looked upon as a solution of the problem of rapid transit, and on the strength of this opinion the Philadelphia Traction Company invested a fabulous sum, estimated to be in the neighborhood of $8,000,000, in equipping the Market Street, Columbia Avenue, and Seventh and Ninth Street lines. But while they were an improvement over the jogging horse cars, they by no means proved satisfactory, and it is with no regret that the cable system has followed the horse car line in giving place to the trolleys. The cost of construction of the cable lines was enormous in comparison with the equipment of the trolley lines, the cost of operation was greater, and the service rendered was less efficient. As a consequence, the cable cars have been forced out of service by the system which has demonstrated its superiority. The machinery at the power stations, now lying useless and idle, represented to the Traction Company an immense amount of money, and it would appear on the surface to be a sheer waste of hundreds of thousands of dollars to dispose of all the gigantic driving gear for a mere song to be broken up for scrap iron. Yet it is useless for any other purpose, and the Traction Company has disposed of it all to a scrap iron firm for the best bargain it could obtain—the great winding drums, around which the greased cables passed, and the heavy driving machinery, weighing thousands of tons, all of which are to be converted into iron and steel junk. Of all the machinery in the immense plants, the engines and boilers are alone valuable above the price of old iron. —Philadelphia Record.

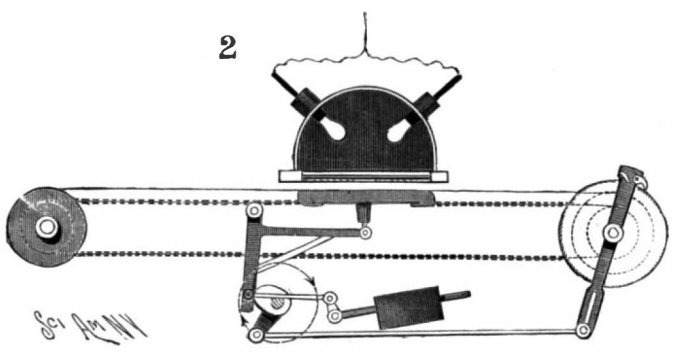

Fig. 2.—DETAIL OF EXPOSING APPARATUS.

An Automatic Letter Registering Machine.

There were in the United States on the first of January 69,912 post offices, and every postmaster is obliged, when requested, to register letters and other mail matter offered, on payment of a charge of 8 cents therefor, and give the sender a receipt. This does not make the government responsible for loss, but facilitates tracing up such mailed matter when necessary. But the taking of a letter to a post office to obtain registry and a receipt therefor from the postmaster or his assistant requires time, and is often attended with not a little inconvenience. To obviate this difficulty a coin-controlled registering machine, applicable also for other purposes, has been invented and patented in the United States and various foreign countries by Count Detalmo di Brazza Savorgnan, of Rome, Italy, at present residing at the Hotel Savoy, New York City.

The machine has a locked registering table and letter-receiving box, to be unlocked by a coin dropped in a slot, which sets in motion mechanism for weighing and numbering the letter or package and dropping it into the letter box, also correspondingly dating, numbering and delivering a receipt therefor. A duplicate register, accessible only to the post office officials, is at the same time made upon a paper band within the machine, this band being formed into a book, and the machine having devices by which it becomes inoperative when the supply of record paper is exhausted. The mechanism for controlling the different movements and operations so that they must occur in regular sequence is described in full detail in the patent, and the Patent Office has allowed twenty-six claims for novelty in the invention. It is designed, by the aid of this improvement, to render it possible to register a letter almost as conveniently as one now drops it into a letter box, these machines being provided at suitable places, as in the leading hotels, large office buildings, etc. We understand that the New York post office officials intend to place one of the machines, when completed, on trial in this city.

Atlanta Exposition Notes.

Mr. A. Macchi, Commissioner-General for Europe for the Cotton States and International Exposition, has returned to America to superintend the installation of the exhibits from the European countries, which comprise splendid products from Belgium, France, England, Germany, Austria, Hungary, Italy and Russia. The exhibition of foreign-made bicycles is likely to prove of particular interest. A fine opportunity of comparing the foreign machines with those of American make will be afforded. Manufacturers in England, France and Italy will send bicycle exhibits. Great Britain has been quick to appreciate the advantages of exhibiting at the fair, as she consumes large quantities of the products of the cotton States.

The exhibit of the mineral resources of the United States to be made at the Atlanta Exposition, under the direction of Dr. David T. Day, of the Geological Survey, will be, the doctor says, the most thoroughly representative and best classified exhibition of the mineral resources of the country.

The feature of the exhibit will be four oil paintings, each 120 feet long, showing four sections of the Appalachian range of mountains, drawn on the scale of one foot to a mile. By these paintings every mineral and coal vein in the Appalachian system will be seen, and the picture will show at a glance the immense wealth of the region in these products.

Signal Service Wanted.

The Board of Police Commissioners of New York City, at their meeting July 26, adopted the following resolution upon recommendation of Commissioner Andrews:

"With a view of selecting a police telephone and signal system for the use of this department, the board invites all persons interested in systems of this kind which have been in successful operation to submit to the board information in regard thereto.

"Such propositions as are made, the board announces, must include a perfect system of electrical and telephone communication between the station house and parts of the precinct; it must be simple of construction and capable of being readily understood and operated, yet be strong and durable and involving all the modern improvements in the line of police signaling.

"Information for the use of the board should first be submitted in written form, accompanied by such drawings and illustrations as may be necessary for a preliminary investigation of the merits of the various systems. Later the board expects to be able to afford opportunity for the practical operation and comparison under the supervision of the officers of this department of such of the proposed systems as are deemed worthy thereof.

"In extending this invitation it is expressly understood that the department has at the present time no fund available for the establishment of a system, or even for experimental purposes. All expense must, therefore, be borne by the parties offering their systems for investigation, and in no event can there be any liability upon the police department."

An adequate police signal system will cost about $500,000.

Test of the Gun Lift Battery.

The members of the Board of Ordnance and Fortification witnessed the test of the new gun lift battery at Sandy Hook on August 7. The battery is the first one with a gun lift completed and in operation in the United States and was the first to be officially tested. It forms part of the defenses of Sandy Hook. The battery is composed of two modern twelve-inch guns which are mounted on the new gun lifts, which differ from the Crozier-Buffington disappearing gun carriage heretofore tested, in that they lower the guns some distance below the parapet and are worked by hydraulic machinery, and not automatically by the recoil of the gun. The disappearing carriage, so called, is only lowered a few degrees below the parapet; the guns, which are mounted on the gun lifts, are placed on the top of a conical mound, the sides of which can be swept with rapid fire guns; the battery is worked on the "pair' system, that is, when one gun is being fired, the other of the pair is being loaded below and is raised for its discharge when its mate disappears. In the test ten shots were fired, five from each gun of the pair. After deducting the time lost while waiting for passing vessels to get out of range, the ten shots were fired in about thirty-eight minutes.

IN China, "the land of opposites," the dials of clocks are made to turn round, while the hands stand still.

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A Primitive Tobacco Factory.

China is nothing unless she is primitive, and although the factory which forms the subject of these remarks is not exactly situated in Chinese territory, as it is in the Portuguese settlement of Macao, it is, to all intents and purposes, a Chinese factory, for it is owned and worked by Chinese. The premises comprise several large sheds with earthen floors, and one or two better built rooms, used as storehouses. The factory gives employment to several hundred Chinese men and women. I was accompanied on my visit by Mr. A. A. Pettigrew, a son of Mr. Pettigrew, of Cardiff Castle, who is at present (May) on a tour in the East. The tobacco is not grown at Macao, but at a place called Hokshan, about forty or fifty miles to the northwest of the former town, on one of the numerous mouths of the Sikiang or Canton River. When the plants are properly dry they are done up into bales about 2½ feet long, 2 feet wide and 1 foot deep, and sent down to Macao in junks. On arrival at Macao, these bales are stored in the premises of the factory until such time as they are required for the manufacture of tobacco.

The first room we entered was devoted to stripping the leaves from the stalks, these being discarded in the manufacture. Women, sitting on the floor on their haunches, were busily engaged in this operation when we entered. The sight of us did not distract the women's attention, but several young children who were present on our arrival scampered away to distant corners like mice into a hole. The dust from the tobacco leaves got into our noses and throats and caused us to sneeze and cough, much to the delight of our celestial onlookers, as evidenced by the loud outburst of laughter which followed our discomfiture. Strange to say, we did not hear a sneeze or a cough from any of the Chinese while we were in the factory. After the leaves have been stripped from the stalks, they are carried into one of the sheds in large bamboo baskets by men, then spread on a wooden floor and damped with water. When sufficiently damp they are made up into layers about 2½ feet long, 2 feet wide and 2½ inches thick and placed on boards.

The next process is to make each layer into a solid cake. This is done in the following way: About a dozen layers, with a board 1½ inch thick between each layer, are placed on the top of one another and then pressure is brought to bear upon the whole lot by means of a lever of the second order, in the shape of a thick pole. One end of the lever is fixed firmly with strong ropes, and this constitutes the fulcrum; the weight or the resisting substance is the tobacco, and the power is applied at the other end of the lever by means of stout ropes, which pass round a wooden axle that is securely fastened to the ground.

When the tobacco leaves have been properly pressed, the cakes are taken out and cut crosswise into strips 4 inches wide and the two ends cut off, as they are not sufficiently pressed. The next step is to tie half a dozen of these strips together by means of ropes. The next operation is to make the tobacco ready for use. This is done by means of a plane, very similar in shape to an English carpenter's plane.

The strips of tobacco are stood up on end on the ground and kept in position by boards made for the purpose. As the strips are only about 1½ foot high, the men have to work the plane in a half stooping position, a most uncomfortable way of working from an Englishman's point of view. However, the Chinese do not appear to mind it, as they work away contentedly from morning to night. The shavings of the tobacco leaves are the tobacco ready for smoking. Every man puts his shavings, as he takes them from the plane, into small heaps, weighing about a pound each, inclosing at the same time a ticket with the name of the firm on it in the center of each heap. These small heaps are then put into papers, the two ends of the papers being left open. The packets are then weighed and a little more tobacco is added or taken away, according to whether the packet is too light or too heavy. When the packets are of the proper weight they are put into another paper, both ends closed up and then packed in boxes ready to be sent away.

There is a good deal of order in the way in which the factory is worked. Women are only employed in stripping off the leaves from the stalks, men do all the rest of the work. There is one lot for damping and pressing the leaves, and another batch for cutting the pressed cakes into strips and tying them up ready for planing. The planers only make the tobacco and put it into heaps, a separate lot of men put it into the first papers ready for weighing.

The men who weigh the tobacco pass it on to others who put it into the second paper, and these finally hand it to the packers.

The tobacco is of a dark brown color and is only used, so far as I know, by the Chinese. It has the reputation among them of being a particularly good brand, and the factory is said to be one of the largest in South China. It was very amusing to see the workers at 12 o'clock, as this is the time they take their midday meal. As soon as the clock struck twelve, everything stopped as if by machinery. In less than five minutes tables were produced from unlooked for corners, basins of rice and other foods were placed upon them, and the men were busily engaged in emptying them by the aid of chopsticks. All the workmen took this meal in the same place as they had previously been working in.—W. J. Tutcher, Botanic Garden, Hong-Kong.—The Gardeners' Chronicle.

Advancement in Dental Surgery—Implantation of Teeth.*

Some eight or ten years ago a now famous dentist of San Francisco made a wonderful stir among his scientific brethren by conceiving and performing the operation of implanting a tooth in the jaw of a patient, and by so doing filling a vacant space caused by the forceps.

Since then, after much experimenting and an endless amount of theorizing upon the several subjects of transplanting, replanting, and implanting of teeth, this wise investigator acknowledged that of all his operations in this branch of dental surgery, for one reason or another, he had to expect failure in about twenty-five per cent of his cases.

His method was, after making an incision through the gum, to prepare a socket in the alveolas, or, in the event of its being absorbed, in the maxilla; then the tooth, which had been carefully kept in an aseptic condition, was ligated securely to the contiguous teeth and the patient was instructed to protect it from injury or shock, and to refrain from using it in mastication until a union should take place between the implanted tooth and the bone.

The principal consideration of the old operation was the preservation of the pericementum; and pages of dental magazines and hours of time have been devoted to the vital importance of preserving this membrane, or at least a part of it, as the success in consolidation depended upon its presence.

Now, other dentists, while admiring the success of this "Father of Implantation," commented upon the failures and fell to speculating upon the fact that one case would be a success where success was hardly to be expected, and other cases would fail in spite of every precaution that could be taken.

The principal enemies of the old methods were two—first, complete absorption of the root, and second, a tendency to remain loose in the artificially prepared socket—and it appeared for many years as though the tissues would not tolerate an implanted tooth except under the most favorable conditions, so much so that even to this day there are leading dental surgeons who class this style of operation as unsurgical.

The above objections naturally limited the performance of these cases to the most progressive students among the practitioners of dentistry, and also confined the class of patients to those who would consent to the experiment, or to those cases in which the patient could not grow accustomed to an artificial denture of the regulation pattern.

Through an accidental discovery by a prominent Parisian dentist, the importance of the preservation of the pericementum was completely disproved. This remarkable specimen was a jaw where a deciduous molar had remained in position, being locked securely between the first bicuspid and first permanent molar; its position being such that the second bicuspid was unable to assume its position in the dental arch and remained buried in the alveolas.

Upon the unerupted tooth the traces could be plainly seen upon the roots of the deciduous tooth, they having been first absorbed by the process of development of the permanent tooth; and as the crown could not be dislodged, resorption took place and the remainder of the deciduous roots became a part of the alveolas by becoming solidly soldered to the bone, which led to the conclusion that such an absorbed root will become a part of the jaw, provided, however, that it can be retained in an immovable position until the union takes place.

Experimentation followed, which led to proof of the non-necessity of the pericementum, and also that by a partial decalcification of the tooth root many of the obstacles in the way of the success of the old method would be overcome; as the cellular structure of the cementum is quickly and easily acted upon by the resorbing or soldering action of the bone cells of the maxilla.

Since the truth of the above statements has been clearly proved, by the fact that if such an implanted tooth remains undisturbed for a few weeks it is impossible to extract it as other or natural teeth are extracted, another decided improvement suggested itself to a prominent dentist of San Diego, Cal., which was in the use of roots of teeth alone for implantation, and after the solidification had taken place, attaching a crown of porcelain of proper color, size, and shape to fill the vacancy. It is a well known fact among dentists that no two teeth that have grown in different heads are alike in color, shape, and size, and only about one tooth in one thousand can be used without showing a marked contrast to surrounding teeth.

* By Dr. D. Cave, of San Diego, Cal. In the National Popular Review.

The method pursued by me differs materially from any of the old plans, and is substantially as follows:

The tooth is first carefully selected for its adaptation to the case in hand. The crown is severed from the root, which is then deprived of its pericementum and shaped to suit the operator.

The nerve canal is thoroughly cleansed and a platina tube is fitted into it, the apex of the root being filled and hermetically sealed.

It is then treated to a bath of boiling bichloride solution, after which it is decalcified by a solution of hydrochloric acid and neutralized with ammonia.

A cap of gold is made to fit the exposed end of the root and to this is soldered a dowel of iridio-platinum; this being secured in position, the root is dipped into a solution of iodosalol and allowed to crystallize.

This is all the treatment necessary. The root being now ready for implantation, a saturated solution of cocaine is used hypodermically to anesthetize the tissues surrounding the site of the proposed implantation, and a section of the gum is removed with a small tubular knife.

The artificial alveolas is prepared, the instruments used being a set of specially prepared bone-cutting instruments, driven by an Edison electric motor at a high speed.

The root is then fitted into place; the entire operation of cutting, drilling, and fitting being accomplished in from five to seven minutes.

After a lapse of from four to six weeks to allow the soldering process between root and alveolas to become complete, the gold cap and dowel are removed and a porcelain crown is attached which has previously been trimmed to articulate with the antagonizing teeth.

The operation, when complete, presents a most natural appearance, both as to color and form, no gold being visible except by very close examination.

One of the incidental features of this process is that the gums adapt themselves to the form of such an implanted root, or at least have a very strong tendency to do so, and will always adhere closely if there is no other opposing force than the new root; whereas, in the old process, all tendencies were toward absorption and shrinking away of the gums, leaving more and more of the tooth root exposed. This has been partially overcome, in some few cases, but the majority of them are as above stated.

The operation as here described is absolutely painless from start to finish, there being no soreness nor pain at any time during or after the implantation.

Insects Which Are Man's Friends.

The lady bird, so quaintly marked that it is hard to find two of them just alike, is one of the gardener's best friends, yet hundreds of them are killed because people in their ignorance don't know what a helper they have in this pretty, buxom little insect. A few days ago a writer in the New York Tribune visited a friend who has a garden full of all sorts of flowers, and back of these there is the kitchen garden, with rows of currants and raspberry bushes. The leaves of both these shrubs were covered with blight or lice that were as green as the leaves on which they lived and thrived. Hunting about the bushes were a number of lady birds. The woman in her ignorance was killing these right and left, thinking they were doing all the damage, and when told they were her best friends was incredulous. A few minutes' careful watching, however, showed the small bug busy eating the smaller green pest. Small yellow pyramids showed where she had laid her eggs, which in a day or two would hatch. The woman saw and believed, and in future the lady bird has a sure refuge and a welcome in her patch of flowers and fruit.

Another insect that is forever being killed owing to the ignorance of the general public is the dragon fly, also known as the needlecase. He is one of the most useful insects of this climate. In his larval state he subsists almost entirely on those small squirming threads which can be seen darting about in any still water, and which hatch out into the sweet singing mosquito. As soon as the dragon fly leaves his watery nursing ground, and, climbing some friendly reed, throws away the old shell and flies away, he is helping man again. His quarry now is the house fly. Not long ago the writer saw one of these insects knocked down in a veranda, where he had been doing yeoman's service, and the children and women seemed delighted, although they shrank back from the poor wounded dragon fly. They all thought he had an awful sting at the end of his long body—a cruel injustice. When the writer took the insect up there was general wonderment, which was increased when a captured fly was offered him and he ate it greedily. The boys of that household will never harm a dragon fly again.

A Ferris Wheel in London.

The great wheel at Earl's Court, London, built upon the same general plan as the Ferris wheel at the World's Fair, has been completed and was opened to the public on July 6. The top of the wheel is 300 feet above the ground and about 40 minutes are required for a complete revolution.

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The Psychology of a Jury in a Long Trial.*

Take twelve men from active life, confine them in a court room six hours a day, and expect them to observe closely, remember and reason soundly on the evidence offered, with no guide except some general principles of law and equity. They are also expected to exercise judgment and discrimination of facts that require training in the most favorable surroundings. In reality the ordinary jury is selected from active working men unused to confinement, and unable to think and reason continuously on any topic outside of their everyday life.

They are untrained to discern the probable facts in a contested case, and understand the real from the apparent in the arguments of counsel. The confinement of the court room, its bad, vitiated atmosphere, with the changed diet of hotels in a long trial, make them still more unfit. A grouping of some facts will make clear the purpose of this note. In a recent murder trial seven farmers on the jury were confined five days in the court room and hotel. They all suffered from indigestion, and two of them were ill in bed for some weeks after. One of these men was a Second Adventist, and the counsel referred to the certainty of the sudden coming of the end of the world and the strict accountability of each one, and urged an acquittal of the prisoner, which was done. The effect of confinement, overeating, and bad, poisoned air, with mental strain to accommodate themselves to the unused requirements of the position, react on the brain, making its operations more unstable and uncertain. After the third or fourth day the judgment of an average juror dwindles into caprice and changeable whims. A certain number will become possessed with a dominant idea concerning the case, which will grow under any circumstances irrespective of all reason or judgment. It becomes literally an "obsession," that is, not changed, although another view may be accepted for present purposes. Others will be thoroughly confused and mentally demoralized, and incapable of coming to any conclusion. The evidence will be a chaotic mass, from which they are unable to extricate themselves. The longer the trial, the more bewildered they become, and at last follow the lead of the majority in despair of anything better. Another class becomes more and more indifferent to the merits of the case, as their physical condition deteriorates; their only interest is to reach the end of the trial; like the former class, they sit listless, neither seeing nor hearing anything with intelligence. At the close they join the majority in any verdict. Another class of superficial, vain men take great satisfaction in the power this position brings them, and are governed in their judgments by the flattery of counsel. When told they have excellent judgment and will decide in such a way, they follow this advice, evidently. There are always men with a mental "twist" or bias in the average jury. In good surroundings and in good health this would be concealed, but after a day or more in the court room it becomes a dominant factor. Strong religious, temperance and political views intrude themselves, whenever the man becomes at variance with his surroundings, and its natural physical and psychical influences. Lowering and changing the degree of health and functional activities makes him more intolerant of the divergent views of others. After the second or third day of a trial, appeals to these conceptions and efforts to make some facts apply along these lines are always effectual. Emotional, impulsive men, who are controlled largely by the surroundings, are always objects of concentrated interest by shrewd lawyers. In the first part of the trial they are not so influential as later, when the mental status has dropped down; then they may become infused with certain conceptions of the case, particularly for punishment or acquittal. The morals of a jury on a long trial are lowered markedly near the end of the case. If undue influence is used or if such influences are purchased, the time to do this is when the effects of confinement, bad air, food and derangement of the physical system appear. However honest a jury of average men may be, a change of surroundings and physical vigor will react on their conceptions of right and wrong and strangely incapacitate them. If any of the jury are invalids, or have been confined with dietetic or neurotic diseases in the past, the changed conditions of the jury room are very likely to bring out some entailments of this condition, still further complicating their mental soundness. Pessimistic men who are in ill health are always ready to recognize guilt and inflict punishment in every case. Their ideas of justice are always based on vengeance and punishment. The suspicion of crime is always a reality and evidence to the contrary is deception. Many of these men in excellent physical surroundings would act and reason with fairness, but change the surroundings and degree of health, and they are unsound and unreliable. The psychology of a jury on a long trial furnishes a range of facts that, when understood, the verdict of these men could be predicted with great certainty, no matter what the evidence may be.

* Read before the Psychological Section of the Medico-Legal Society, Nov. 12, 1894, by T. D. Crothers, M.D., superintendent Walnut Lodge Hospital, Hartford, Conn.—From the National Popular Review.

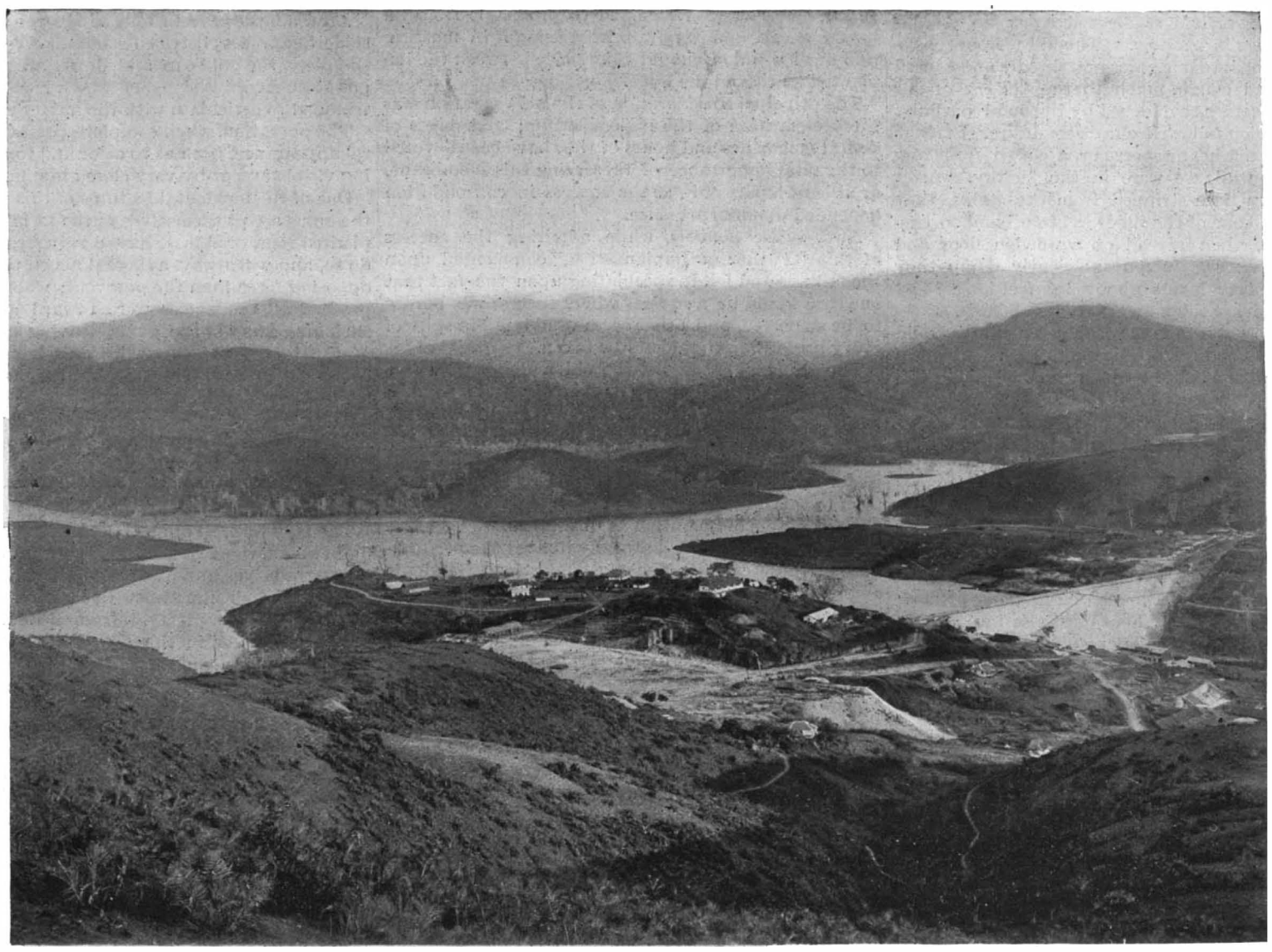
PROF. DURAND, in an article in Cassier's Magazine, discusses ship propulsion by storage batteries, and concludes that for the same amount of energy storage batteries at present weigh about 550 times as much as coal and occupy about 220 times the space.

THE GREAT DAM OF THE PERYAR, INDIA.

The Peryar work is that of turning the water of the Peryar River, flowing westward through the well-watered mountains of Travancore, in South India, eastward through the sterile plains of the Madura district. Six miles west of the eastern brow of the Travancore Mountains the great dam is being erected by which a lake is being formed that is to turn and empty its overflow into a tunnel already cut through the eastern brow, a tunnel 5,700 feet in length by 7½ feet high and 12 feet broad.

The first illustration shows the dam with the lake. So recently has the lake been formed that the partly submerged trees are seen sticking out of the water, some of them still struggling, as it were, for their life.

The buildings on the knoll in the center are the residences of the engineers. The cutting between the houses and the spur of the mountain in the left foreground is to be the water escape when the dam is raised to its intended height. It was a great task to cut that down in the solid rock. The stone taken out has been utilized in the construction of the dam, being carried down to the river bank by a gravity railroad running to the buildings at the foot of the dam and conveyed thence by moving buckets suspended on cables that are stretched from point to point wherever material is needed.



THE GREAT DAM OF THE PERYAR, INDIA.

It was at this workshop below the dam that the most serious accident of the whole enterprise occurred.

Mr. Taylor, the superintending engineer, was standing over a large horizontal wheel that conveyed the power from the turbine to the buckets, when a bucket came moving along overhead. To avoid the bucket he moved aside and fell on to the horizontal wheel and was caught and mangled. He lived but a few hours after.

The dam rises from a width of 138 feet at the bottom to 22 feet at the top. Stone masonry on each side, with a solid mass of cement within, is the method of construction. As it rises it is to extend over the hill at the further end until its length will be 1,300 feet. At present the length is about 1,000 feet. The river at the bottom was originally about 300 feet wide.

One of our illustrations shows the top of the dam with the swarms of coolies working on it.

The quantity of water in the dam varies greatly. In the driest months it diminishes to something like 100 cubic feet a second, with occasional small freshets of 1,000 to 3,000 cubic feet a second, of short duration.

During the monsoons it increases to an average of 2,000 cubic feet a second, rising at times to 20,000 or 30,000 cubic feet a second. The largest recorded flood was in November, 1873, during a cyclone, in which 28

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inches of rain fell in two days. The discharge then was estimated at 120,000 cubic feet a second.

The following are further particulars kindly furnished by A. T. Mackenzie, Esq., one of the engineers:

When finished the dam will be 178 feet high, 12 feet wide at the top, with a parapet 4 feet high and 4 feet thick, and will contain 5,000,000 cubic feet of masonry.

The bed of the river is solid rock; so there are no underground foundations, and the dam is actually 178 feet above the lowest water level.

The present height is 136 feet and 4,200,000 cubic feet of work is already done. The depth of water is 89 feet, but the escapes are now stopped and the lake is being allowed to rise to 128 feet depth, where a new set of escapes are ready for it.

The area of the lake will be 14 square miles and the outflow through the tunnel 1,600 cubic feet per second. Its maximum depth at the dam will be 174 feet.

The tunnel has been driven all the way through hard syenite, with no slips or soft places, and is a very straightforward and uneventful tunnel.

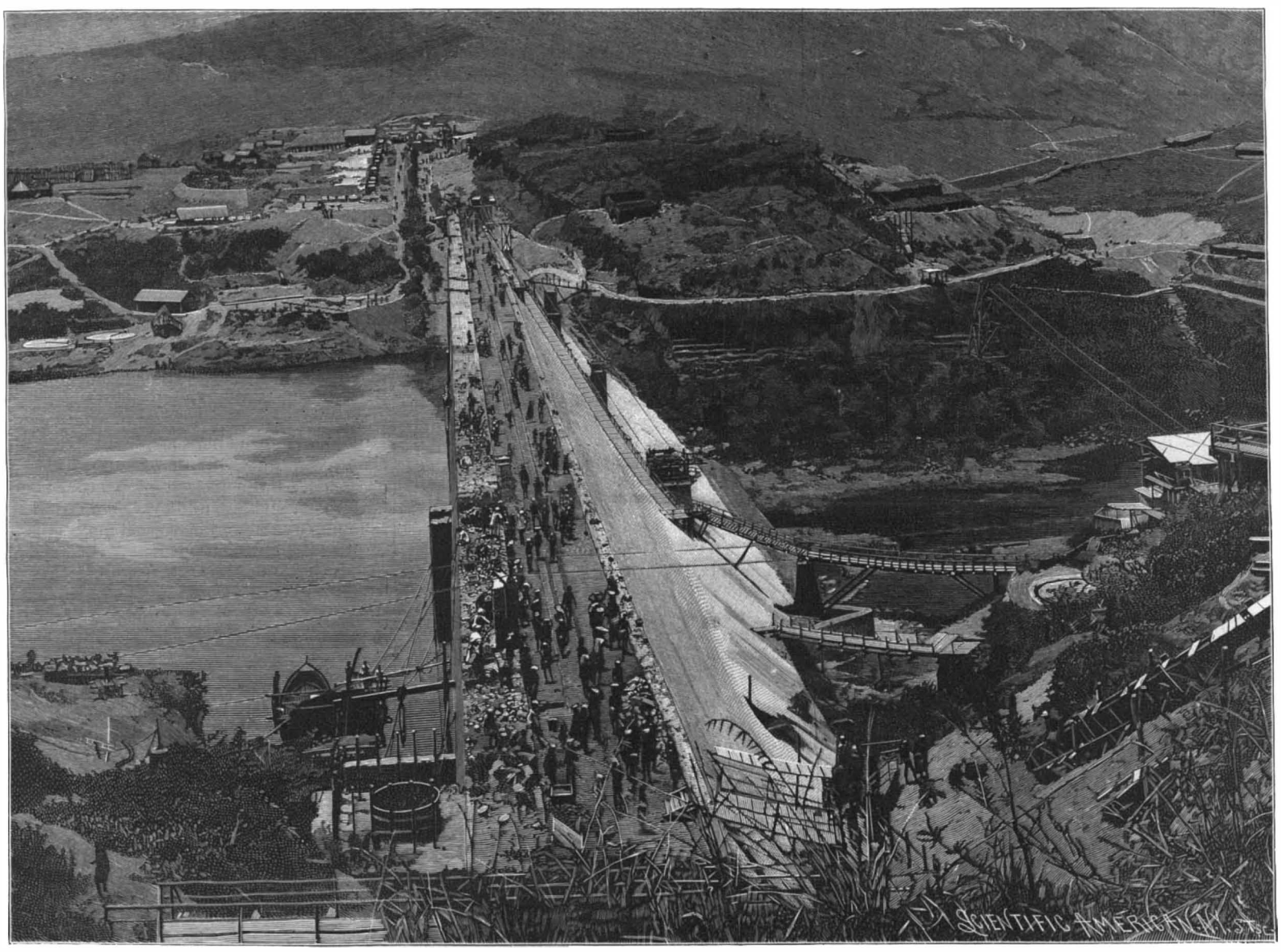
Leading to and from the tunnel is about a mile in all of open rock cutting, 25 feet wide and from 30 feet depth to nothing.

An average of over 4,000 people were employed on dam and tunnel during the last season. Besides the coolies there are three steamers, four turbines from 180 horse power downward, and a large number of portable steam engines, boilers, etc. It is to be finished before April, 1896.

The total cost of the work, including distribution works in the Madura district, will be 83 lacs of rupees, or between three or four millions of dollars. Besides this, the British government pays the Rajah of Travancore 40,000 rupees annually for a lease of 999 years. In return for this the British government is allowed to take all timber comprised in the watershed of the lake, for use on the works, but not for sale or export. It also obtains fishing rights in the lake—a concession worth exactly nothing. It is altogether a very poor bargain for the British government.

But the conception and completion of the work reflects lasting glory and honor upon the enlightened spirit of the British government and upon the skill of all the engineers connected with the Peryar. The illustrations are from photographs taken by Rev. W. P. Elwood, missionary of the A. B. C. F. M.

Madura, May, 1895. J. S. CHANDLER.



THE GREAT DAM OF THE PERYAR, INDIA.

MAXIM'S cavalry gun, which fires 700 shots a minute, weighs but thirty pounds and can be carried strapped to a soldier's back. The gun he made for the Sultan of Turkey fires 770 shots a minute, but it is a field piece on wheels.

Building a Levee with Force Pumps.

Captain George McC. Derby, the able young engineering officer who has charge of the federal engineers in New Orleans, has announced that the attempted feat of building a levee with force pumps on the great dredge, the Ram, was successful. Captain Derby, believing that levees could be built by this means, attempted the experiment on the levee at Nine-mile Point, opposite Carrollton. Captain Derby cannot state yet what the real result of his experiment exactly is, as the present attempt was made with a view to discover a method rather than to avoid expense. Four attempts were made by the engineers. The levee existing at Nine-mile Point before the Ram went to work was of small section and low height. It was desired to enlarge it to a size almost as great again as it then was. The Ram was stationed about 400 feet away, and the piping was laid to the work, so as to permit the pumps to send a stream of sand and water, scooped from the river bottom, to the work. This stream was delivered at a height of about ten feet, and the volume of water was so great that the consistency of the mass was very thin. Captain Derby first threw up a small levee behind the original one, and attempted to fill in the space between the two. It was found that the silt was readily deposited, while the water ran off, leaving a thick, heavy mass of solid earth. As soon as this topped the rear embankment, an effort was made to raise the barrier by increasing its height from the deposit made from the pumps. The material was, however, too dense and glutinous to be worked fast enough, and a crevasse occurred. This method was then abandoned. A framework of lathes, covered with jute bagging, was substituted for the small rear levee, it being thought that the water would pass readily through the bagging and the silt be retained. The result was fairly satisfactory, but very expensive. Planking was then substituted on timber frames, but the stream ate out the toe of the framework and the fluid escaped. The last method was very ingenious. It was found both cheap and efficient. Captain Derby took a plank a foot wide and pinned it on edge about 12 feet away from the toe of the old levee. The board was driven a small distance into the turf, in order to prevent the material from seeping under and escaping. The pumps were started, and in a few minutes a terrace was formed as high as a board, the water escaping over the board. Then a second board was set on the terrace a few feet nearer the old levee. This, too, was filled in, forming a second terrace. It was found, however, that when each terrace was filled up entirely to the height of its defending board, a crevasse was likely to occur when the next terrace was built, and the work ran grave chances of being demolished. Captain Derby obviated this by leaving four inches of each terrace unfilled, thus forming between the toe of the upper terrace and the board defending the outer edge of the lower terrace a sort of cup, into which the overflow from any subsequent crevasse was caught and held. This method was found to work perfectly. Of course, in an enterprise of this kind, its practicability depends on the cost per yard of work done by the dredge. The Ram is very powerful, having been built under contract to deliver 300 cubic yards of material 300 feet distant from the dredge every hour. In practice it was found that she could deliver about 2,000 yards per working day of ten hours. The total cost per cubic yard of a levee built by the Ram to a height of 10 feet will be 3·91 cents per yard. Hitherto the price of levee work has ranged from 10 to 12½ cents on an average per cubic yard.—New Orleans Picayune.

The Tourah Prison.

The chief prison in Egypt for male hard labor convicts is at Tourah, about eight miles south of Cairo, where the adjacent quarries, which once furnished limestone to the builders of the great Pyramids, supply unlimited scope for labor six days a week. There are 950 convicts, and though 100 of them are "lifers," there are others whose term is only for six months. Strict discipline is maintained by sixty-five warders, who are unarmed and do not carry even a stick or whip; but by night there are nine sentries and by day there are four, who patrol the roof and the outside of the prison, and who know how to use their loaded rifles with deadly aim. These sentries are blacks from the equatorial provinces, and have prevented more than one attempted escape. Nearly all the convicts are natives of Egypt, the blacks only supplying five per thousand and the Nubians averaging only two per thousand. Any extra bad characters among the convicts, such as the ringleaders of attempted revolt or escape, are locked up at night in solitary cells to lessen their chances of contaminating their fellows. As a whole, the convicts are by no means of a ruffianly type, and their physiognomies are very like those of the ordinary peasant. In this country, where crime is at such a minimum and where even the lunatics are as quiet as sheep, it is not too much to hope that education and improved environment may one day do much to improve the lot of the townfolk, from whom the convicts are mostly drawn. The "ticket-of-leave" system has not yet been introduced into Egypt, and would certainly be worth a trial, for at present there is very little incentive to well-conducted convicts to lead a peaceful, hard-working life within the prison bounds. Every visitor cannot fail to be struck with the very healthy, well-fed appearance of the prisoners, and on inquiry I was told that there were only fourteen on the sick list. —The Lancet.

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Correspondence.

The Lilac Borer.

To the Editor of the SCIENTIFIC AMERICAN:

Kindly inform me what the specimen is sent by me in a separate package marked borer in lilac bush.

This fellow, or one of his near relatives, seems to be destroying every kind of shrub and tree around my summer residence. Some branches of trees, and very large ones at that, have been sawn through, as it were, and completely destroyed.

The one sent you was taken from the center of a lilac bush's branch. Now the main thing is: What to do to kill this pest and destroyer of trees and shrubs.

You will confer a great boon on me and the people in this vicinity by informing me about this borer and his destruction. H. J. DOLL.

Buffalo, N. Y.

ANSWER BY PROF. C. V. RILEY.

The whitish worm, with light brown head, three pairs of short horny legs on the thoracic segments beneath and five pairs of membranous prolegs, one pair each on the sixth, seventh, eighth, ninth, and last segments of the body, sent by Mr. H. J. Doll, of Buffalo, N. Y., is the lilac borer, larva of Podosesia syringæ (Harr.) This is one of the Ægerian moths, which in general appearance and in flight recalls one of the paper wasps belonging to the genus Polistes. The wings are narrow, the front pair smoky brown, the hind pair transparent between the veins, and the legs long and banded with yellow and black. The female lays her eggs in patches on rough or knotty places on the bark of lilac or ash, and on branches generally from one to three inches in diameter. Sometimes, however, the larva is found in the main trunk or in branches of seven inches and upward. The egg hatches in about six days and the larva at once eats through the bark into the solid wood. The larva pupates in May in a slight cocoon, after cutting a passageway to the bark, leaving only the thin outer covering thereof, and the moth issues some three weeks later, the chrysalis having pushed its way partially out of the bark to facilitate the emergence of the moth, as is the habit of other members of the family.

The work of this particular insect is confined to the lilac and ash, and my own experience in Washington and elsewhere would indicate that it is even more troublesome to the ash than to the lilac. There are also in this latitude two generations annually, so that I have known young ash trees that were growing vigorously in spring to be entirely riddled and killed during a single year.

Your correspondent is mistaken in attributing the injury to other kinds of shrubs to the work of this particular species, and the probabilities are that the trunks and branches of other trees which have been sawn through as he describes are affected by some other insect, of which almost every tree and shrub has its own particular species. There are, in fact, so many that it would be useless to offer suggestions without more definite and specific information, though the probabilities are that he is troubled by the larva of the leopard moth (Zeuzera pyri), a comparatively recent introduction from Europe, but a species which has multiplied exceedingly and has proved very destructive, especially in New York State.

The lilac borer is not easy to deal with, and the best preventive that I can suggest is to prune the bushes down well and then paint the branches with a mixture of air-slaked lime and Paris green, in the proportion of 1 part of the green to 15 or 20 of the lime. This should be done early in May and repeated later if heavy rains wash off the mixture. The parent moth will probably avoid such trees or shrubs, but if she should oviposit on the limbs thus treated, the newly hatched larva will perish in endeavoring to eat into the wood.

The Tiger Swallow-tail.

The smooth caterpillar, of a greenish color, characterized by a continuous black transverse band bordered with yellow across the fourth segment dorsally and by having a pair of small eye-like spots, one on each side of the second segment, sent by Mr. H. S. Burroughs, of Silver Bay, Lake George, is the larva of one of our prettiest swallow-tailed butterflies (Papilio turnus). It is known as the tiger swallow-tail, because the color of the butterfly in its commonest form is yellow, with black transverse bands. This larva feeds on a number of different plants and particularly on plum, cherry, liriodendron or tulip tree, birch, poplar, magnolia, linden, pear, ash, catalpa, hop, beech, alder, hickory, willow, lilac, etc. The lilac is given as its favorite food in the North by Mr. S. H. Scudder, who is one of our best authorities on the New England butterflies. The eggs are globular and yellow and laid on the under side of the leaf. The chrysalis is pale yellowish gray, inclining to brown, and is characterized, as are most of the chrysalides of the genus, by a medio-dorsal prominence on the thorax and by two ear-like projections on the head. It is attached by the tip of the body to a little bundle of silk and suspended around the waist, so to speak, by a thread of silk.

An interesting fact in connection with this butterfly is that in the Southern States, more particularly, but reaching as far north as New York and Wisconsin, a dimorphic form occurs in which the yellow of the wings is replaced by a dull black, this variety being known as glaucus Linn., and confined to the female sex. The caterpillar rarely occurs in sufficient numbers to be injurious.—C. V. R.

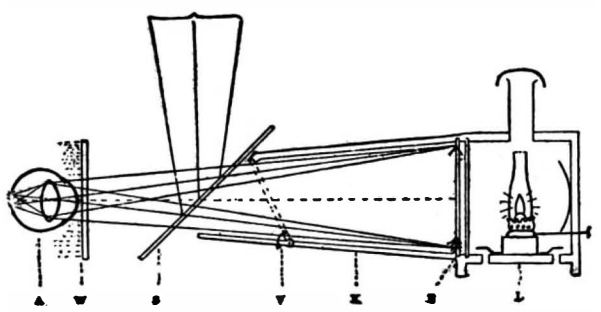
PHOTOGRAPHY OF THE RETINA.

This apparently impossible feat has been performed several times, having been first accomplished in 1893 by M. Londe, a member of the French Société de Photographie. We translate from Gaea, Leipsic, May, an account of an improved method used with great success by Drs. Grebe, of Cassel, and Greeff, of Berlin.

"The eye to be photographed, A (see illustration), is furnished with a water cell, W, according to Gerloff's system, to avoid reflection from the cornea. Before it a clean plate of glass, S, is so placed that the rays from a source of light of the desired intensity can be thrown by it into the eye. At P is a sensitive plate that is sheltered from outer light by means of a box, K. The box can be closed by a pneumatic shutter, V. On the plate, P, are cross lines which, when the plate is illuminated by the red lantern, L, can be seen by the eye.

"The feat is performed in the following manner: The eye is brought to perfect rest by means of a head support. Then the glass plate is so turned that a provisional point of light above appears to lie in the middle of the shutter, V. Then in perfect darkness the shutter, V, is opened and the eye is focused on the cross wires of the red-illuminated plate. Everything is now ready for the photography, which is accomplished by flash light.

"The procedure can be understood without further explanation. With a minimum of light quite a large picture may be taken directly; the focusing is the



sharpest imaginable, because it is done with the eye itself. The smaller the picture, the sharper will be the outlines. Near-sighted eyes are very good for photographing."—Literary Digest.

Cycle Notes.

A. Mercati, secretary of the Hellenic Committee of the International Olympic Games, which will be revived at Athens April 5 to 15, 1896, announces that the management will provide four international bicycle races, which will be run on a new track, which is to be built for the purpose. The programme of the races is as follows: There will be a 2,000, a 10,000 meter, a 100 kilometer, and a 12 hour race. The two former races will be without pacemakers and the last two with pacemakers. The rules of the International Cyclists' Association will govern the contest.

The volunteer service, or militia, of Great Britain includes about 7,000 bicyclists. For several years the signal corps of the Connecticut militia has been equipped with bicycles. In Belgium the bicycle is utilized for the quick moving of troops. General Nelson A. Miles recognized nearly a year ago that in the next great war the bicycle will become a most important machine for military purposes.

Something new in the way of a bicycle trip is claimed for the journey made by four riders near Virginia City, Nevada, recently. They started in at the mouth of the Sutro Tunnel on two tandems and rode through the tunnel to the shaft station on the 1,750 foot level of the Consolidated California and Virginia Mine, a distance under ground of 4½ miles.

Bicyclists in Hillsdale County, Mich., have found a new diversion in chasing woodchucks over the prairies on their wheels and running them down. Given a fair distance to run before striking cover, the bicyclist usually wins and gets the woodchuck.

To clean the bicycle chain, remove it from the machine and soak it in turpentine for several hours, then clean it with a brush, as an old tooth brush, link by link, and after this dip it in clean kerosene oil and dry thoroughly with cheesecloth. See that both sprocket wheels are thoroughly cleaned and then replace the chain. Do not use oil on the chain, as it produces a clicking sound. Use graphite or any of the various chain lubricators now on the market.

The best way to clean the bearings of a wheel is to take them out and then remove all dirt and rust from them. Kerosene may be used to remove the gritty substances from the bearings. The kerosene should be poured into the oil well, the wheel being kept revolving constantly. Old clothes should be worn at this job, as the kerosene is likely to splash them. The cleansing fluid can best be poured into the bearings by the aid of an ordinary oil can. Lubricating oil should be run in after the kerosene has been drained off.

An electric bicycle lamp is now being introduced into New York City. The lamp is provided with a current from a storage battery, which furnishes sufficient current to actuate the lamp for about twenty hours. The total weight of the battery and lamp is about 2½ pounds. The battery can be recharged at authorized agents' stores for ten cents each.

A fair estimate of the bicycle output of 1895 would be 350,000 wheels of all kinds.

A twenty-four hour bicycle contest at the Herne Hill track ended July 27. The winner, Mr. Hunt, covered 458 miles and 1,459 yards, and Mr. Bennett 447 miles 75 yards. Fifteen men started, but only four finished.

A middle-aged woman in an old wrapper and sunbonnet was an odd figure as she rode her bicycle to her neighbor's along a Connecticut road recently. The keeping of a horse is no longer an absolute necessity to life far from a railroad station.

A milkman of Wissahickon, Pa., uses a bicycle in serving his early morning customers. He has invented a little rig for strapping a milk can safely to the machine. Tricycles have been used a long time by milkmen, especially in England; but this is probably the first instance of the rather unstable bicycle being used for this purpose.

The bicycle is being put to practical use in Philadelphia. In addition to policemen being mounted on wheels, the messenger boys in the outlying districts have been provided with bicycles and the service rendered is very efficient, as calls can be answered in less than one-half the time it has previously taken.

An interesting bicycle will shortly be placed on exhibition. It was made by a South American mechanic from a pattern of a wheel which he saw in a magazine. In three weeks this native blacksmith completed a bicycle of a safety pattern which weighs 32 pounds. The whole machine is made in the best possible manner. The tires are made of leather tubes filled with hair and are as easy riding as cushion tires. This is the first wheel ever built in South America by a man who never saw a bicycle.

"The use of the bicycle has expanded and developed from a salutary athletic exercise into a great social obsession. It has seized upon every class of society, both sexes, all ages, and every condition of life. It is taken up by the well because it makes them feel better, by the invalid because it makes them feel well, by tired people because it rests them, and by the rested because it makes them feel tired. The fat ride to get thin and the thin to get fat. It has displaced the horse. It has made the simple and ancient custom of walking most unpopular; it has cut down the function of the steam car and competes successfully with the suburban trolley. The doctors have taken it up and expressed their approval of it, and we are far from saying a word in opposition. The bicycle has come to stay, though not with quite the omnipresent activity which it now enjoys. Already we notice grave and reverend seigniors in our profession riding along the cobble stones in their golf suits instead of lying comfortably back in their victorias. Time that used to be spent in serious scientific pursuits at the hospital, in the laboratory, and at the desk is now shortened in order to enjoy a ride up the Boulevard. The bicycle has cut down the scientific activity of the New York profession at least fifty per cent already."—The Post Graduate."

A Tale of Co-operation.

A coal mine at Monthieux, near St. Etienne, in the Department of the Loire, was abandoned by its owners several years ago because it could no longer be worked at a profit. The discharged miners, finding themselves without work, formed a co-operative concern and obtained a title to the abandoned mine. They then set to work, and by opening new veins, by observing strict economy and unflagging industry, made the mine pay. Now note the result. The mine workers in the neighborhood, engaged with their employers in an eternal wrangle over wages, sought, and in many cases secured, employment in the co-operative concern. The founders of the latter, however, would not admit the newcomers on equal terms with themselves. When it came to the question of wages, for instance, they would not pay the new men the same rates that were paid to the men who by extraordinary efforts had turned a worthless hole in the ground into a paying piece of property. When the new miners resisted and created a disturbance, the aid of the police was invoked and the disappointed element was dispersed. No doubt they looked upon themselves as the victims of capital and the slaves of a mushroom bourgeoisie. To an outsider it only illustrates that thrift, industry, and perseverance lead to success, and that men exhibiting these qualities are not likely, whether wage-earners or capitalists, to allow shiftlessness and indolence to run away with the fruits of their labors.—N. Y. Tribune.

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CHE-FOO.

Che-Foo, where the treaty of peace between China and Japan was signed, and which is still called Yen-Tai, is one of the most frequented ports of the northeast of China. Situated at the rear of one of the bays of the Gulf of Petchili, Che-Foo is near the two places that have been most spoken of during the recent war, viz., at thirty miles from Wei-hai-Wei, and opposite the strong position and the great arsenal of Port Arthur.

It was here that in 1876 had already been signed between England and China the agreement through which three new ports were thrown open to foreign commerce. The signing of the treaty of the 8th of May last between the two hostile brothers of the extreme East is a new historic date for Che-Foo. Let us recall that at the time of the Chinese European war the French forces occupied Che-Foo without resistance on the 8th of June, 1860.

Well populated (it having 120,000 inhabitants, according to the consular reports of 1891), like all Chinese cities, Che-Foo has two physiognomies—an eastern and a western. In summer it plays the role of one of our fashionable bathing places, such as Trouville or Brighton. This port, whither come the foreign colonists from other points of the coast, bears the name of Yen-Tai or Yang-Tai. It is very pretty, with its villas provided with verdure-clad verandas, situated one above another upon the hill that is surmounted by the semaphore, or strewed along the shore, handsome and easy of access. One of our engravings represents this part of the truly picturesque semaphore point. There will be remarked alongside of the signal apparatus a pagoda of fine proportions whose roof rises well into the air. The postage stamp vignettes have widely distributed this silhouette, which is very familiar to the travelers of all nations who put into the commercial port of Che-Foo. The trade is active, both by junks

ONE OF THE GATES OF CHE-FOO.

with other ports of China and by merchant ships with the other parts of the world. America and Russia send petroleum hither and England sends cottonades and metals.

The importation of opium is considerable, and the most notable exportation is that of raw silk. At about two miles from the coast extends the Chinese city properly so called, which is surrounded by a wall of which one of our engravings gives one of the motifs—a high gate in the form of a tower crowned with a sort of lookout. In the interior there is a truly Chinese swarming of beasts and people, and of merchandise and detritus, that mingle their goings and comings, their colors and their odors in the little narrow streets with low houses and with sunken earth that is swampy after a rain and covered in dry weather with a thick stratum of dust. The remains of fish and rotten fruit and the odor of opium and tobacco smoke prevail everywhere. It is a living party-colored picture in a suffocating atmosphere.

Let us return to the quarter that spreads out at the edge of the sea. It was here in a simple inn, with the European sign "Beach Hotel," that the treaty of peace was signed by the Japanese and Chinese plenipotentiaries. With its likewise English vis-a-vis, the Sea View Hotel, the view of the sea in which are anchored the French, English, German, Russian, and Italian ships in observation, and in this scene that our correspondent has sketched from nature one might think himself at Portsmouth at, for example, the time of the last international naval review.

The few groups of idlers here and there, the palanquins to the left that await the coming out of the diplomats, and the picket of honor of Chinese soldiers, who are guarding the door behind which so great interests are being regulated, give the scene its local color. These Chinese soldiers with their brightly colored uniform, their drawn sabers and their strange-shaped halberds, exhibit a more decorative than martial appearance, and under their straw hat their impassive face expresses scarcely anything but the ennui of a long faction.—L'Illustration.

A STREET IN CHE-FOO.

The Pasteur Institute.

The returns published by the Annales de l'Institut Pasteur for the first quarter of the current year show that during that period 345 persons were under treatment for the prevention of hydrophobia, of whom 276 were French and 69 foreigners. Of this total 23 were bitten by animals experimentally proved to be mad, 224 by animals declared by veterinary certificate to be so, and 98 by animals only suspected to be so, the bites having been inflicted in 329 cases by dogs, in 15 by cats, and in one by a donkey. Only one death is reported as having occurred during the three months—namely, that of Johnson Stewart, 48 years of age, a native of Glasgow, who, having been bitten in London on March 8 by a dog which was declared to be mad after a post-mortem examination made by a veterinary surgeon, came to the Pasteur Institute on the 11th, and was under treatment up to the 23d. On that day, after having taken a warm bath, he caught a chill while riding outside an omnibus, and took to his bed, symptoms of hydrophobia manifesting themselves two or three days later, and causing his death on April 1.

Simultaneously the Annales give the figures for the past year, and these show that 1,392 persons were treated last year, and that of these 12 died, the mortality being, therefore, less than 1 per cent; while if the five deaths of persons who succumbed within a fortnight of treatment are deducted, as in fairness they should be, the mortality is reduced to ½ per cent.

The following table gives the number of persons who have been treated at the institute since M. Pasteur's discovery was made: 1886, number of persons treated, 2,671; deaths, 25; rate of mortality per cent, 0·94. 1887, number of persons treated, 1,170; deaths, 14; rate of mortality per cent, 0·79. 1888, number of persons treated, 1,622; deaths, 9; rate of mortality per cent, 0·55. 1889, number of persons treated, 1,830; deaths, 7; rate of mortality per cent, 0·38. 1890, number of persons treated, 1,540; deaths, 5; rate of mortality per cent, 0·32. 1891, number of persons treated, 1,559; deaths, 4; rate of mortality per cent, 0·25. 1892, number of persons treated, 1,790; deaths, 4; rate of mortality per cent, 0·22. 1893, number of persons treated, 1,648; deaths, 6; rate of mortality per cent, 0·36. 1894, number of persons treated, 1,387; deaths, 7; rate of mortality per cent, 0·50.

The nationality of the patients treated last year was 1,161 French, 128 English, 26 Greeks, 26 Spaniards, 19 English subjects from India, 16 Belgians, 7 Turks, 2 Dutch, 1 Russian, and 1 Egyptian.

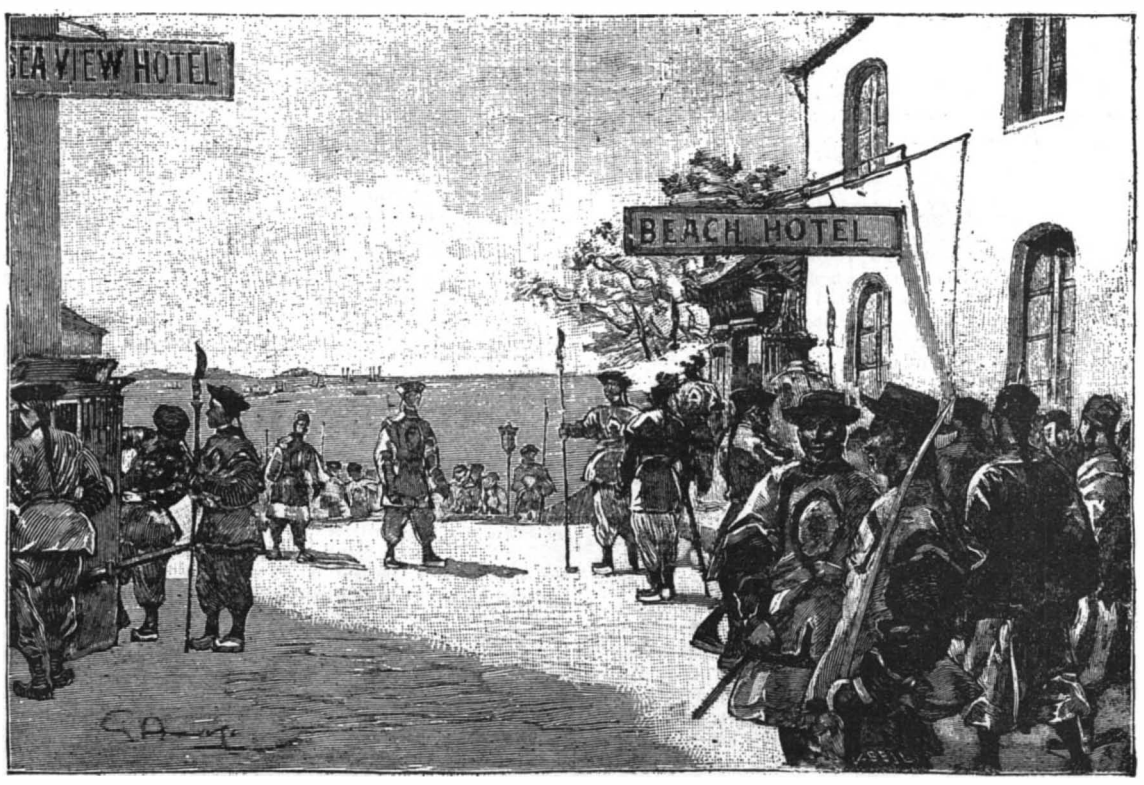
The Horseless Vehicle.

In matters of transportation, no question is more generally agitating the public mind than that of horseless vehicles. In France, more than any other country, their possibilities are being tested as to speed and adaptability, and the results are in the main satisfactory. This fact has led the enthusiast to promulgate all kinds of ideas as to the future of the horse, etc., and an endless amount of unmitigated nonsense is being published in the public press. That this class of vehicle is destined to become a prominent factor none can doubt, and it is well to be prepared. It should be remembered, however, that it is not a new idea. Carriages to run on common roads without horse power were experimented with before the iron rail was laid, and engineers have been experimenting continuously ever since. New methods of generating power have given a renewed impetus to the movement, and the prospects are more than ever favorable, and we do not doubt their use in many places where the conditions are favorable. The horse will not be dethroned; neither will the time ever come when the horseless vehicle will hold other than a secondary place. There are many adverse conditions to be overcome in the mechanical construction and in the matter of traction, and in our northern climate, where snow and ice prevail for several months of the year, they will be useless during those periods. Their construction, however, has reached a stage when it may be well for the carriage and wagon manufacturer to give it consideration. Be made they will, and if carriage builders who are well equipped to produce them continue to antagonize their construction, stock companies, with ample capital, will be formed, and by securing the patents they will control the manufacture and prove formidable competitors. Their manufacture and sale legitimately belong to the carriage and wagon trades, and the Hub thinks it is not too early to prepare for the control, for if it once gets out of the hands of vehicle men, it will not be recovered. We hope, the editor adds, to see some of our enterprising builders interesting themselves in this matter before the present year closes.

SEMAPHORE POINT, CHE-FOO.

Enlarged Photographs.

The photographic branch of the N. S. W. Government Printing Office have already established a name for the production of large photographs. To the Chicago exhibition they sent a panoramic view of Sydney measuring 24 ft. in length and which was officially catalogued as the largest photograph that had then been produced. This record has, however, been beaten by the same office, as they have just produced a view of the recent annual show held by the Royal Agricultural Society of New South Wales in Sydney, that measures 26 ft. 3 in. in length by 3 ft. 10 in. wide, and which is claimed to be the largest ever produced. The panoramic view was taken on 8 plates, 15 × 12, and enlarged on bromide paper. The finish of the picture is very good, the identity of individuals from 100 to 200 yards away from the view point being readily recognizable.



HOTEL IN WHICH THE TREATY OF PEACE BETWEEN CHINA AND JAPAN WAS RATIFIED.

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The Cost of British Ships of War.

A Parliamentary paper recently issued throws much light upon the cost of warships and their armament, machinery, etc. The prices given are mainly those to contractors, but from other sources the expense of building ships in the public dockyards can be obtained. No real comparison can be drawn between the two, of course, for the maintenance of the public yards is imperative for many sound reasons, and therefore there are items connected with the cost of vessels built in them from which those constructed in the private yards are free. However, when we remember that the private builder has to make a profit, we must not be surprised at the cost of employing them, and it has been fully demonstrated that it is as essential to the efficiency of our resources to give experience to the private contractors as it is to maintain public establishments. Messrs. Thomson, of Clydebank, for the hull and machinery of the battleship Jupiter, are to receive £732,683, and for the cruiser Terrible about £570,000. Messrs. Laird will receive for the battleship Mars, £733,211; and the Barrow Company as much for the cruiser Powerful as Thomsons do for her sister ship. Messrs. Maudslay, who are the agents for the Belleville boilers in England, receive in royalties for the French firm, £10,600. but they will not construct the boilers in their shops. The Talbot class of cruiser, of which several are being constructed in Scotland, costs about £210,000 apiece, while the torpedo boat destroyers average about £35,000 apiece.

Rewards for Inventors.

According to an article in Engineering, a very early case in which the work of an inventor was rewarded is recorded by the celebrated Italian philosopher Jerome Cardan. In his work "De Subtilitate," which first appeared in 1550, he speaks of an artificer of Brixelendum who had invented, among other ingenious devices, a machine for sifting or bolting flour, for which he had obtained a privilege from Cæsar. Brixelendum, or, as it appears in some of the later editions of the book, Brixelensem, is probably the same as Brixellum, now Bresello or Bregella, a town in Italy, on the Po. The Cæsar referred to would appear to have been the Emperor Charles V, who held very enlightened views on government, which, unfortunately, his stormy reign prevented being carried into effect to any considerable extent.

Quoting from the French edition of 1556, Cardan explains that he alludes to the invention "in order that men may understand how it is possible to acquire great riches by little things, provided that they are ingenious. [This sentence reads very like some productions that we come across in our own days.] For now that the bakers have this instrument for their profit, and that the inventor has the privilege of Cæsar that no one can have it without his consent, he is so busy that in a brief time he has built a house." Cardan gives a sketch of the machine, which comprises a casing inclosing an inclined sieve provided with a knocking device operated by a handwheel outside the casing.

The earliest authentic cases of the grant of patents in England date from 1560. They are discussed in articles in Engineering, vol. xxxvii, pages 804 and 773, the former treating of the introduction of the manufacture of hard white soap, the latter of saltpeter, into this country. The first recorded instance of reward to an inventor occurs in the same year, when Jacobus Acontius, of Trent, was granted an annuity of £60, apparently as result of his petition in the preceding year for the issue of a prohibition against the usage, without his consent, of his discovery of wheel machines for grinding or bruising, and furnaces for dyers and brewers. It appears that a few years afterward he received a patent also.

In 1565 John Humphry, in the Tower, received a patent for the "sole use of a sieve or instrument for melting of lead, supposing that it was of his own invention." He appears to have brought an action for infringement. In court the question was, as stated by Noy, "whether it was newly invented by him, whereby he might have the sole privilege, or else used before at Mendiff, in the West Country, which, if it were there before, the court was of opinion he should not have the sole use thereof." Emery Molyneux, however, in offering the Queen (Elizabeth), in 1570, his inventions of shot, artillery, etc., appears to have thought it a sufficient recompense to be allowed to enter her service. Another inventor, in 1575, brought forward "an engine of war whereby 24 bullets can be discharged from one piece at a time;" he wished for a pension. In the same year we have the application of Peter Morrice, a German, for a patent for the sole right of making and employing certain hydraulic engines for the raising of water, draining marshes, etc. A few years afterward this invention was applied at Old London Bridge for the purpose of forcing up river water into the city for drinking purposes.

Do Horses Weep?

Do horses weep? is a question discussed by our contemporary the Admiralty and Horse Guards Gazette. It tells us that there is a well authenticated case of a horse weeping during the Crimean war. On the advance to the heights of Alma, a battery of artillery became exposed to the fire of a concealed Russian battery, and in the course of a few minutes it was nearly destroyed, men and horses killed and wounded, guns dismounted, and limbers broken; a solitary horse, which had apparently escaped unhurt, was observed standing with fixed gaze upon an object close beside him; this turned out to be his late master, quite dead. The poor animal, when a trooper was dispatched to recover him, was found with copious tears flowing from his eyes; and it was only by main force that he could be dragged away from the spot, and his unearthly cries to get back to his master were heartrending. Apropos of the intense love that cavalry horses have for music, a correspondent of the Gazette writes that when the Sixth Dragoons recently changed their quarters a mare belonging to one of the troopers was taken so ill as to be unable to proceed on the journey the following morning. Two days later, another detachment of the same regiment, accompanied by the band, arrived. The sick mare was in a loose box, but hearing the martial strains, kicked a hole through the side of her box, and making her way through the shop of a tradesman, took her place in the troop before she was secured and brought back to the stable. But the excitement had proved too great, and the subsequent exhaustion proved fatal.

RECENTLY PATENTED INVENTIONS.

Agricultural.

PLANTER.—Walter W. Burchell, Sutherland, Iowa. This inventor has devised a self-dropping attachment operated from one of the ground wheels and connected with the seed drop slide. The attachment may be readily carried into or out of locking engagement with the ground wheel, and may be readily applied to any planter having a reciprocating drop slide, or to a drop slide of any type with a change of coupling.

PLOW STOCK. — Joseph W. Abbott, Lockhart, Texas. A cultivator frame of simple and inexpensive construction is set forth in this patent, the frame admitting of being conveniently changed to facilitate the grouping of the sheaves or plows to be carried by the stock. The frame has a central beam and lateral zigzag beams forming three projections at each side of the central beam, there being adjustably secured to the projections side beams to which are connected handles.

Electrical.

HEATING RUG.—Jesse R. Davis, Parkersburg, West Va. A casing containing a resistance coil, according to this improvement, has two electrodes concentrically arranged therein and a metallic distributing plate extending entirely across both electrodes and properly insulated therefrom. The outer case may be of wood, canvas covered with asbestos, metal, porcelain, etc., and the rug may be of any desired shape most convenient for heating or warming the feet, under desks, in carriages, or on floors anywhere, the heat as it is transformed from electrical energy being retained by the resistance of the heating medium.

Miscellaneous.

REVOLVING AIR PUMP.—Vatslav A. Hlasko, New York City. For readily forming a vacuum in electric light globes and other apparatus this inventor has devised a pump in which a bulb is mounted to turn about an inclined axis passing approximately through the center of the bulb, the latter containing a pumping liquid, while a pipe adapted for connection with the article to be exhausted is connected with the bulb, to turn with it. The pipe is arranged at such an angle to the inclined axis that by turning the bulb with the pipe the liquid will be caused to flow outward from the bulb or return into it. At each revolution of the device an amount of air corresponding to the capacity of the bulb and pipe is drawn from the vessel to be exhausted, trapped and discharged.

WATCHCASE. — William M. Rush, Jr., St. Joseph, Mo. This case has a postage stamp holder in one of its lids, and a corresponding recess or depression in the adjacent lid, the stamps being held against displacement by an overlapping thin piece of spring material.

FISH HOOK.—Frank D. Pettey, Hampshire, Ill. This device comprises a rod with a device for holding bait in connection with self-opening hooks which are closed and concealed at their points, but which are adapted when released to spring in opposite directions, the locking device being released by tension on the line. When the fish is landed it may be readily released from the hook.

DECOMPOSING SUBSTANCES BY AMMONIA SALTS.—Eduard R. Besemfelder, Gross Mochbern, Germany. This invention is for a process of separating metals from ores and other insoluble materials, and for the utilization of certain waste materials, as strontian residues from the desaccharization of molasses, permitting the recovery of the reagents. At the critical pressure and temperature the compound is treated with ammonium chloride in a dry state, the superfluous reagents, with the volatile products, being separated by distillation or sublimation from the non-volatile residue, and from this the soluble part is separated by a solvent.

TYPE AND MATRIX.— Coelestin Skatulla, Brooklyn, N. Y. This invention provides improved means of forming matrices for linotype machines, by first casting short letters and assembling them into words, with space bars between to form the proper length of line, and then casting a backing on the line to unite with the short letters and fill the spaces between the words. The line matrix comprises single short type with a cast backing to make the matrix the proper height, the spaces between the words being filled.

WOVEN CHENILLE FABRIC.—Leedham Binns, Philadelphia, Pa. This invention relates to a formerly patented invention of the same inventor, the fabric comprising a central warp, on opposite sides of which are separate sets of warps some of the wefts passing over the central warp and others under it, the wefts forming bends where they bind the central warp and the ends of the wefts projecting from the outermost warp threads in the several sets, forming tufts or loops.

HASP.—William Firfield, Perth Amboy, N. J. This hasp is so formed in sections that when applied to an object and engaged with a staple or other keeper, the section secured to the support by screws or fastening devices will be completely covered by one of the other sections, which will extend over its face and top and bottom edges, rendering it impossible to remove the fastening devices while the hasp is in locking engagement with its keeper.

STOVE.—James A. Carroll and William Brooks, Brooklyn, N. Y. Above the fire chamber of thisstove is suspended a heating drum having its lower wall inclined downward and rearward from the side adjacent to the stove door, there being an air flue communicating with the interior of the drum. The cold air is taken from the floor and carried to the drum, where it is heated without coming in contact with the fuel, and the fire may be reduced and controlled without danger of gas escaping into the room.

DITCHING MACHINE.—Alexander Mann, Berkshire, Mich. To effectively dig up the ground and transport the removed material to a desired dumping place, this machine is made with a pair of winding drums and carrier rope, scrapersbeing detachably secured in the runs of rope, while a pivoted boom carries a hoisting rope with means for engaging the scrapers. There is a wheel on the pivot of the boom to which is secured a rope having its ends fast to a second pair of winding drums, and means are provided for operating both pairs of drums.

ORE AND COAL LOADER.—Patrick H. Hageney, Ashtabula, Ohio. This machine comprises a boom adapted to carry a bucket, and bars pivotally connected with the boom have a sliding motion to push the bucket into the material to be raised to fill the bucket. The machine is preferably mounted on a truck on which turns a cabin or house containing the operative parts, to be manipulated from within the cabin, and is more especially designed to facilitate loading coal, ore, and other material into cars.

DIVING APPARATUS.—Hubert Schon, Allegheny, Pa. This apparatus is more especially designed to properly locate sunken vessels preparatory to raising them. It consists principally of a casing with frames having angular flanges bolted together, panels set and fastened in the frames, a top bolted to the upper end of the casing and adapted for connection with a cable, while a bottom bolted to its lower end carries a weight. It is made of a size to permit two or more persons to occupy the casing several hours without change of air. It has glass panels and is lighted from the inside, to permit the occupants to closely examine sunken objects as the apparatus is lowered.

GRAIN SCALPER. — Adam W. Haag, Fleetwood, Pa. This improvement relates to screens for bolting flour, etc., providing a screen to be supported in horizontal position and have a gyratory motion with quick return. With an uninterrupted motion the screens are rotarily reciprocated in a lateral direction, the movement of the screen rearward or in the direction of its head being much greater than the movement in direction of its tail, causing the material to move in the direction of the tail, whereby the advantages of the gyratory motion are obtained and a feed is provided for the screened material.

BICYCLE.—George B. Thomas, Durango, Col. The driving mechanism of this wheel is designed to give increased power and speed as compared with the ordinary treadle power. The rear or drive wheel of the machine is much larger than the front or steering wheel, and both have supplemental interior rims, the rear wheel having also an inner fly wheel. The main frame has front and rear yoke portions and the pedal axle journaled in the lower end of the front yoke portion has cranks connected by pitmen with cranks of the main axle, the crank motion being thus more directly and uniformly distributed at each side of the drive wheel.

STARTING RACE HORSES.—James T. Andrew, Montgomery, Ala. To facilitate the starting of a number of horses simultaneously this inventor provides stalls, to be operated singly or in sections, with gates all to be raised together on a given signal for the horse and rider to pass out, each animal to be at the same instant struck from behind by a striking arm. The construction is such that the stalls may be conveniently set up and operated on a race track and readily taken out of the way.

PORTABLE KITCHEN CABINET.—Lester Haskill, Fort Meade, Fla. For conveniently keeping, and sifting when required for use, flour, meal, etc., this inventor has devised a neat and compact cabinet which can be made at a low cost, means being provided for stirring the meal or grits as drawn from the bins, so that the sieves may be kept clean and in good order. The cabinet also has drawers for spices, sugar, etc., and is preferably mounted on casters, so that it will be as convenient to move about as a table or other article of furniture.

CHAIR.—William G. Magee, Hudson, N. Y. An invalid chair which combines the functions of a reclining chair, a rocking chair and a wheeled chair is provided by this invention. The position of the chair in relation to the wheels is shifted by a simple adjusting mechanism, there being other novel devices for changing the chair from one form to another, the chair being automatically converted from a reclining to a roller chair by simply moving the body and rocking the chair forward.

SASH LOCK.—Irving Elting, Saugerties, N. Y. This is an improvement on a formerly patented invention of the same inventor, providing an improved device for positively preventing a rotary movement of the locking plate which engages horizontal grooves on one of the sashes to hold it against vertical movement.

WIRE FASTENER.—Oliver Swift, Aberdeen, South Dakota. This is a device for securing the strands of wire fences to the posts, and consists of a headed stem passed through a perforation in a clamping block having at one side a projecting toe adapted to enter the post, the toe being separated from the perforation through which the stem passes by a space which receives the fence wire. A wire fence can, with this fastener, be built more cheaply, as the posts may be placed farther apart, it being impossible to force the clamps out, the wire breaking rather than pulling out the clamps.

BONBON DIPPING MACHINE.—Leo Hirschfeld, New York City. A table pivotally mounted upon a frame, according to this improvement, has channels upon one of its faces to receive the material to be dipped, there being means for holding one end of the table elevated. Located over the channeled portion of the board is a feed wheel having a series of radiating blades, and the motion of the wheel is controlled by a ratchet and pawl mechanism. This wheel is mounted in adjustable boxes to be raised or lowered to suit different sizes of material, the machine affording a quick and efficient means of dipping candies in making any form of confectionery.

FORK FOR DIPPING BONBONS, ETC.—This is a further invention of the same inventor of a fork adapted to receive any desired number of bonbons or other confectionery, the candies after dipping being simultaneously dropped into the moulds or wherever they are to be deposited. The head of the fork has tines mounted to turn and having receivers to hold the bonbons, there being also in the head a rack and a trigger operated mechanism whereby the tines may be turned without turning the body of the fork.

COFFEE SURROGATE.—Jeremiah B. Drake, Bolivar, Mo. To effect economy in the use of coffee and yet provide a beverage of good quality and flavor, this inventor has devised a compound to be used in connection with a proportion of pure coffee. It consists of sugar, caffeine, cream of tartar, caffeol and corn starch, mixed and roasted in described proportions.

LAMP. — James Forsythe, Pittsburg, Pa. This lamp has valve devices by which, no matter which way the wind blows, the air passages to the windward will be held closed while the others remain open, there being also in the top an inverted cone-like deflector to prevent the currents of air having a counteracting effect on each other. The air valve devices are also designed to prevent the lamp from being smothered by becoming clogged with soot or by the condensations freezing in the bottom and thus closing off the air holes.

HORSE CHECKING OR UNCHECKING.—Felix H. Kittrell, Loco, Tenn. This invention is for an attachment for driving harness to permit of releasing the check rein, to allow the horse to lower his head, and the retightening and fastening of the rein without getting

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out of the vehicle. The check strap is extended beneath a gripping cam on the saddle and is made to act on a rearwardly projecting arm to release the cam by being lifted or moved upwardly. To check up the horse again it is only necessary to pull back on the strap.

KNEE PROTECTOR.—Thomas B. Walker, Honolulu, Hawaii. For the use of cavalrymen and others to protect the rider against rain, snow, etc., this inventor has devised a new article of manufacture to be made of leather, rubber or waterproof cloth. It comprises both a knee and thigh protector, arranged for ready connection with each other and with the trousers legs or boots or leggins. The knee protector is of somewhat triangular shape, with side flaps at the lower corners and rounded at the top to conform to and bend over the knee.

STRING FASTENER.—Charles C. Pine, New York City. For fastening shoes, corsets and other articles to be laced, this inventor provides a device for holding the string end without tying the string or using springs, jaws, etc., the fastener being more especially designed for use with flat strings. A body piece adapted to be fastened to the shoe or corset has a narrow slit for the passage of the string, the slot being arranged in alignment with the back pull of the string, and the latter passes over the body piece and twists on entering the slot. Only the string end has to be passed through the slot to fasten the string in place.

PAPER DOLL. — Edward T. Gibson, Minneapolis, Minn. This invention relates to dolls in which changes of costume can be made by the adjustment of paper garments, the doll being destitute of arms and shoulders, and preferably destitute of head and neck. By means of a locking key the assembled parts of the doll are so firmly held together that the doll may be tossed about without disarranging the parts, and an extension of the key serves to support the doll in nearly upright position.

GAME APPARATUS. — Joseph Jessup, Woodbury, N. J. A game to be played in simulation of the game of football is provided by this patent, a foldable board being used, marked off as a football field, while a movable block has the position of the opposing teams indicated thereon, a series of dies indicating the different players, character of play and distances on the field. It is designed that those who have played this game will better appreciate all the points of a good game on the field.

DESIGN FOR WRENCH HEAD.—Walter T. Johnston, Macon, Ga. This head has a rounding and transversely serrated top surface, one projecting end presenting a bifurcation and the opposite projecting end being concaved at the under side.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

SCIENTIFIC AMERICAN

BUILDING EDITION.

AUGUST, 1895.—(No. 118.)

TABLE OF CONTENTS.

1. A Colonial house at Scranton, Pa. Perspective elevation and floor plans. Cost complete $4,500. E. G. W. Dietrich, architect, New York City. A simple yet pleasing design.
2. A cottage at Residence Park, New Rochelle, N. Y. Two perspective elevations and floor plans. Architect, Mr. G. K. Thompson, New York City. A unique example for a cottage dwelling.
3. Perspective and floor plans of a Colonial cottage at South Orange, N. J. Built by H. E. Matthews, Orange, N. J. A neat design, with some novel features.
4. A Colonial house at Summit, N. J. Perspective elevation and floor plan. Architects, Messrs. Child & De Goll, New York City.
5. A cottage in the suburbs of Brooklyn, N. Y., erected at a cost of $7,500 complete. Perspective elevation and floor plans. Architects, Messrs. J. C. Cady & Co., New York City. An artistic design.
6. Two perspective elevations and floor plans of "Lover's Dell," a residence recently erected in New Jersey. A pleasing example for a modern Colonial dwelling. Architect, Oscar S. Teal, New York City.
7. A residence at Sea Side Park, Bridgeport, Conn. Two perspective elevations and floor plans. An exquisite design. Architect, Mr. W. R. Briggs, Bridgeport, Conn.
8. A residence in the Colonial style, recently erected at Chester Hill, Mt. Vernon, N. Y. Three perspective elevations and floor plans. A picturesque design. Lewis H. Lucas, architect, New York City.
9. Ground plan and perspective view of Holy Trinity Church, Harlem, N. Y. Architect, Mr. Wm. A. Potter, New York City.
10. A residence at Montclair, N. J., being an additional view to those of the same house published in the May issue.
11. Miscellaneous contents: Waterbury electric heat regulator, illustrated.—A sanitary bathtub, illustrated.—Finishing floors.—Pompeian bath room.—Seasoning of stone.—Improvement in warm air furnaces, illustrated. — An improved domestic water service system, illustrated.—An improved door check and spring, illustrated.—The wood of most uses.—The hollow handle glass cutter, illustrated.

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References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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(6598) T. D. B. asks: 1. Will you please tell me the name of inclosed leaves and greatly oblige several parties? A. Charles W. Dabney, Jr., of the Department of Agriculture, informs us that the leaf which you inclose is that of the common poison ivy, Rhus radicans. 2. Please give formula and an example of increase of candle power due to increase of amperes in an incandescent lamp. A. An increase in the amperes will increase the light of an incandescent lamp because both heat and light are determined by the power used by the lamp. Electrical power is measured in watts, which are calculated by multiplying the amperes by the volts. W=CE. (1) A 16 candle power lamp should use about 60 watts, when the pressure is 115 volts. From formula (1) we obtain (2) $C=\frac{W}{E}$ hence $C=\frac{60}{115}=0.52$ ampere. If in formula (1) C is made larger, the product CE becomes larger; that is, more power in watts is used and more light is given. This answers the question as asked, but the result cannot be gained in this way. With a given lamp and generator capable of lighting it, no variation in the amperes can be made. Ohm's law is $C=\frac{E}{R}$ amperes $=\frac{\text{volts}}{\text{ohms}}$. Dynamos for incandescent lighting usually have a constant voltage, and the resistance of the lamp may be said to be constant. The voltage of the dynamo only varies as its speed may change, and the resistance of the lamp only changes by decreasing as the filament grows hotter, or increasing as the lamp wears out; so that there is ordinarily a uniform amperage passing in a lamp. To increase the light given by an incandescent lamp, the voltage of the current must be increased. This should not be done, because it will wear the lamp out too fast. A comparatively small increase of pressure will reduce the life of the lamp by a half. The only other way to increase the light is to make a lamp with a lower resistance, that is, with a shorter or larger filament. This is the method actually employed.

(6599) P. W. says: Please tell me through your paper: 1. What is celluloid composed of? A. Celluloid is a hard elastic compound made by subjecting gun cotton, camphor and other ingredients to hydraulic pressure. See our SUPPLEMENT, No. 227. 2. Some simple way of pressing flowers, especially double flowers, so as to preserve their shape and color. A. A method of preserving the natural colors of flowers, recommended by R. Hegler in the Deutsche Botanische Monatshefte, consists in dusting salicylic acid on the plants as they lie in the press, and removing it again with a brush when the flowers are dry. Red colors in particular are well preserved by this agent. Another method of applying the same preservative is to use a solution of 1 part of salicylic acid in 14 of alcohol by means of blotting paper or cotton wool soaked in it and placed above and below the flowers. Powdered boracic acid yields nearly as good results. Dr. Schonland, in the Gardeners' Chronicle, recommends, as an improvement in the method of using sulphurous acid for preserving the color, that in the case of delicate flowers they might be placed loosely between sheets of vegetable parchment before immersion in the liquid, so as to preserve their natural form.

(6600) J. D. writes: I am figuring on a refrigerating plant, to be operated by the use of compressed air, and would be glad if you will state how many cubic feet of air, atmospheric pressure, at a temperature of 20°, would be required to cool say one gallon of water to a temperature of 34°. the water being in a coil of pipe placed in a receiver into which the compressed air is expanded to ½ pound above atmospheric pressure. Please advise how many units of heat are contained in one gallon of water at 70°. also at 34°; also how many units of heat in one cubic foot atmospheric air at 90° and at 20°. A. The difference of 70°—34°=36°×8½ pounds of water per gallon equals 300 heat units. The specific heat of air for equal weights with water is but 0·237, and as 13 cubic feet of air at 60° equals one pound, then 90°—20° $=\frac{70°}{13c'}=5·39\times0·237=1·277$ heat units per cubic foot from 90° to 20°. As the mean difference of the water above the air temperatures at its lowest point is 32°, then $\frac{32°}{13c'}=2·46\times0·237=0·583$ heat unit for each cubic foot of air expended in cooling, and as 300 heat units are required, then $\frac{300}{0·583}=514$ cubic feet of free air at 20° to cool one gallon of water from 70° to 34°. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 999, on "Cooling by Compressed Air."

(6601) P. B. V. says: Please give me through Notes and Queries a formula for a black hair dye. A. 1. Black:

Sulphate of iron	10 grn.
Glycerine	1 oz.
Water	1 pt.

The hair must be thoroughly washed with this, dried and brushed once daily for three days; then the following should be applied on a small tooth comb, but it should not be allowed to touch the skin if the other preparation has done so, as a temporary stain would result. Or 2,

Gallic acid	4 grn.
Tannic acid	4 "
Water	1½ oz.

After the first application of formula 1. the hair should be allowed to dry and then be brushed. Subsequently, both formulæ may be used once daily at an interval of an hour or so, until a black color is produced. All preparations of lead and mercury are injurious if used for any length of time: they may, however, be legitimately used where some small portion of hair has, from personal idiosyncrasy, lost its color, which cannot be restored.

(6602) F. and M. say: Have you receipt for working over and restoring rancid butter to fresh, sweet flavor? A. To Convert Rancid Butter.—1. 100 pounds o butter is mixed with about 30 gallons of hot water, containing ½ pound of bicarbonate of soda and 15 pounds of fine granular animal charcoal free from dust, and the mixture is churned together for half an hour or so. The butter is then separated; after standing, warmed and strained through a linen cloth, then resalted, colored and worked up with one-half its weight of fresh butter. 2. To Sweeten Rancid Butter.—Rancid butter may be restored, or at all events greatly improved, by melting it with some freshly burnt and coarsely powdered animal charcoal (which has been thoroughly freed from dust by sifting) in a water bath, and then straining it through clean flannel. A better and less troublesome method is to well wash the butter with some good new milk, and next with cold spring water. Butyric acid, on the presence of which rancidity depends, is freely soluble in fresh milk.

TO INVENTORS.

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INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

August 6, 1895,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Advertising caster, C. E. Larrabee ... 543,938
Air brake coupling, W. A. & B. S. H. Harris ... 544,253
Alarm. See Fire alarm. High or low water alarm.
Alarm lock for tills, electric, C. Helm ... 544,224
Armatures for dynamo-electric machines, construction of, W. B. Sayers ... 543,895
Atomizer, C. Wagner ... 544,143
Autographic register, H. C. Biette ... 543,842
Baby carrier, portable, A. W. Webster ... 544,074
Bag. See Traveling bag.
Bag machine, E. S. Staples ... 544,197
Baling press, J. W. Hunter ... 544,255
Bandage, R. Jacks ... 544,062
Bar. See Boring bar.
Barns or other buildings, frame for, P. Deville ... 544,215
Barrel, ash, C. A. Hurley ... 543,937
Battery. See Electric battery. Primary battery. Stamp battery.
Battery plates, machine for making, T. T. Lewis ... 544,180
Bearing, anti-friction, F. M. Lechner ... 543,875
Bearing, ball, F. M. Lechner ... 543,876
Bed bottom, wire, J. R. Larlew ... 543,904
Beer pipe cleaner, A. B. Ogden ... 544,191
Bell, magneto-electric, L. Moore ... 544,107
Belt lacing, device for forming, C. K. Judson ... 544,177
Bench. See Kneeling or foot bench.
Berth, self-leveling, W. T. Milligan ... 544,065
Bicycle, G. A. Graves ... 544,165
Bicycle fork crown piece, Beecher & Cornforth ... 544,082
Bicycle frame, W. K. Bellis ... 544,021
Bicycle lock, J. D. Shoots ... 544,132
Bicycle pedal balance attachment, J. R. Bliven ... 543,844
Bicycle support, W. H. Hart, Jr ... 544,223
Bicycles, obtaining two speeds in, S. J. Collier ... 544,267
Bismuth oxyiodidgallate and preparing same, F. Lady ... 544,104
Bit. See Drill bit.
Boiler. See Steam boiler.
Boiler cleaning device, D. Waight ... 543,144
Boiler covering, H. C. Michell ... 543,964
Boiler fuel feeding apparatus, A. O. Muller ... 544,187
Boiler furnace, steam, R. Muller ... 544,108
Bone grinding machine, H. P. Chapman ... 544,087
Book rack, C. E. Foster ... 543,959
book support, C. H. Hay ... 544,170
Bootjack, R. Jacks ... 544,063
Boot or shoe, W. Norton ... 544,263
Boring bar, J. E. Fluke ... 544,250
Bottle or can labeling machine, R. & C. F. Schmidt ... 544,127
Bottles, stoppering, W. J. Kelly ... 544,178
Box. See Miter box.
Brace. See Chair brace.
Brake. See Car brake.
Brasses, automatic adjustment for, J. H. Dales ... 544,213
Brick press plunger, P. L. Simpson ... 544,054
Bricks, etc., machine for moulding and pressing, W. A. Gill ... 544,090
Brush, W. R. Derr ... 544,030
Brush, W. Van Kleeck ... 544,141
Brush charger, tooth, T. Hollis ... 543,934
Brush, fountain shaving, E. V. Santee ... 543,969
Brush machine, M. Young ... 544,200, 544,201
Bulb or tube stretcher or expander, Unsinger & Hannes ... 544,268
Burner. See Gas burner.
Cabinet, P. Ullrich ... 544,138
Can opener, A. G. Chaloupka ... 544,058
Candy cutting machine, Frye & Carter ... 543,930
Car brake, B. Sickles ... 543,904
Car coupling, W. B. Brown ... 543,921
Car coupling, A. P. Redmon ... 544,194
Car door, Smith & Hartman ... 544,133
Car draught rigging, railway, C. A. Schroyer ... 544,009
Car, dumping, N. Barney ... 544,020
Car, dumping, W. M. Dunman ... 544,249
Car fender, J. B. Campbell ... 543,924
Car fender, R. O. Clark ... 543,849
Car fender, C. Sullivan ... 543,972
Car fender, C. M. Vandegrift ... 544,139
Car fender and wheel guard, G. E. Shoemaker ... 544,195
Car fender or guard, street, C. S. Yost et al ... 544,244
Car letter case, postal, H. H. Sessions ... 544,131
Car signal, J. S. A. Baker ... 543,955
Cars, device for replacing derailed railway, P. H. Durack ... 544,161
Carrier. See Baby carrier.
Case. See Car letter case. Clock case. Milk vessel case.
Cash register, C. J. Carroll ... 544,247
Cash register and indicator, G. Calder, Jr ... 543,980
Cash register and indicator, E. G. Watrous ... 544,243
Casket, J. Zwack ... 543,974
Caster, E. G. Hoffmann ... 543,870
Caster, H. Ill ... 544,101
Chain machine, W. A. & F. A. Peck ... 543,944
Chair. See Rail chair.
Chair brace, J. E. Carroll ... 544,025
Chin and shoulder rest, H. O. Peabody ... 544,003
Chlorine, apparatus for making, J. J. Powers ... 544,119
Chuck, machine tool, W. Raymond ... 544,006
Churn, Gibbs & Shipman ... 543,861
Churn, C. R. McGahey ... 544,000
Cigar box moistener, J. C. Giaccum ... 543,989
Cigarette machine, B. Baron ... 543,840
Cigarette machine, continuous, B. Baron ... 543,839
Cigarette machines, tobacco feeder for, B. Baron ... 543,838
Circuit closer, W. Nutt ... 543,966
Clamp. See Dental clamp.
Cleaner. See Beer pipe cleaner.
Clock case, W. D. Davies ... 544,028
Cloth and yarn calculating rule, A. Schaer ... 543,899
Cloth stretching machine, J. & W. Horton ... 544,098
Coal transferring apparatus, E. & C. E. Lindsley ... 544,103
Cock, gage, H. R. Frisbie ... 544,033
Coffee surrogate, J. W. Curry ... 544,059
Concentrator, T. J. Hatch ... 544,254
Conveyer, E. R. Draver ... 544,031
Corset fastening, H. Davidson ... 543,983
Corset stiffeners, machine for making, J. Draher ... 543,856
Cotton elevator, cleaner, and distributer, M. M. Ginn ... 544,036
Coupling. See Air brake coupling. Car coupling. Thill coupling.
Coupling device, J. T. Hostler ... 543,935
Cultivator, M. L. Kissell ... 544,102
Cultivator, T. J. Payne ... 544,114
Cultivator or plow standard, J. H. McLain ... 543,886
Curbs and gutters, apparatus for forming concrete, S. P. McKelvey ... 544,235
Current motor, alternating, E. Arnold ... 543,836
Current motor, alternating, R. Lundell ... 544,261
Curtain fixture, window, E. I. Pyle ... 543,946
Curtain pole socket, R. S. Gregory ... 544,166
Curtain stretcher frame, W. Niemand ... 544,049
Cycle driving gear, C. H. H. Steudel ... 544,239
Cyclometer registering mechanism, A. F. Rockwell ... 543,948
Dead centers, device for overcoming, D. Seibert, Sr ... 543,903
Decanter for cooling liquids, L. G. Godet ... 544,219
Dental articulator, M. R. Griswold ... 544,096
Dental clamp, J. M. Strout ... 544,135
Dental engine handpiece coupling, C. H. Davis ... 543,854
Dental flask, M. R. Griswold ... 544,095
Dental motors, short circuiting device for stopping, F. N. Denison ... 543,855
Digger. See Potato digger.
Dish cleaner, W. H. Cox ... 544,211
Display rack, H. Droste ... 544,216
Ditching machine, tile, C. W. & E. Jeschke ... 544,258
Diving chamber, G. A. Russell ... 544,238
Door check, J. T. Hair ... 543,863
Door check, R. C. Simmons ... 544,053
Door fastener, J. Chalmers ... 543,981
Door operating device, E. Brombacher ... 543,979
Draught excluder for doors, Hall & Bayliss ... 543,932
Draw gear and buffing apparatus, G. Westinghouse, Jr ... 543,915
Drier, P. C. Vogellus ... 543,912
Drill bit for boring in coal, etc., mining coal, G. H. Bittenbender ... 544,206
Drills, driving mechanism for multiple, A. J. Oehring ... 544,068
Drum or similar heads, device for securing, I. H. Sapp ... 544,125
Dye and making same, azin, R. Reyber ... 543,894
Easel, C. Beyer ... 544,083
Edger, J. Cox ... 544,158
Egg tester, T. M. Spilman ... 543,970
Electric arcs, method of and means for extinguishing, W. B. Potter ... 543,892
Electric battery, R. M. & A. McDonald ... 543,885
Electric condeser, C. S. Bradley ... 543,978
Electric conductors, connecting ends of, J. T. Beswick ... 543,919
Electric distribution system, E. Thomson ... 543,950
Electric lighting system, E. F. Gavin ... 544,034
Electric meter, J. Harris ... 543,865
Electric meter, safety, W. R. Polk, Jr ... 544,118
Electric motors, controlling switch for, W. J. Pohlman ... 544,236
Electrical conductor, G. Gray ... 543,960
Electrical converters, automatic cut-out for, W. J. Greene ... 544,094
Electrolytic separation, vessel for, W. Borchers ... 544,153
Elevator. See Cotton elevator.
Engine. See Gas engine.
Engine stopping apparatus, G. W. Brown ... 544,085
Eyeglass nosepiece, A. Abraham ... 543,835
Eyelet, metalling buttonhole, J. B. Wheat ... 544,149
Fare register, car, S. M. Balzer ... 544,081
Fastening for cords or the like, H. H. Abell ... 544,076
Fence, S. C. Davis ... 543,853
Fence post, H. A. Wartman ... 544,146
Fence stay, C. C. Keedy ... 543,962
Fence, wire, T. McKerns ... 544,001
Fence, wire, J. R. Peck ... 543,890
Fender. See Car fender.
Fibers, process of treating and products derived from vegetable, T. A. Edison ... 543,986
Fifth wheel, W. P. Champney ... 544,155
File, bill and letter, S. B. Whiteside ... 544,057
File, letter, A. Krab ... 544,231
Filter, M. R. Buckley ... 543,922
Filter, water, M. L. Mitchell ... 544,262
Filtering machine, centrifugal, G. A. Bachmann ... 544,080
Filtering pot or urn, W. A. Van Deusen ... 544,140
Fire alarm, C. F. Scofield ... 543,896
Fire alarm, automatically operated, F. K. Ludlow ... 543,879
Fire alarm signaling apparatus, G. W. Brown ... 544,084
Fire door draught gate, H. R. Hoffman ... 544,038
Fireplace, gas burning, H. G. & W. R. Dawson ... 544,029
Flask. See Dental flask.
Fluid regulator, automatic, S. Alexander ... 544,079
Flume gate, B. Pearson ... 544,069
Folding gate or screen, E. Coppieters ... 543,926
Frame. See Bicycle frame. Curtain stretcher frame. Type case frame.
Frame making tool, J. Schuler ... 544,072
Furnace. See Boiler furnace.
Furnace, J. E. Clarey ... 543,982
Furnace doors, means for opening or closing, D. E. Robinson ... 543,968
Game apparatus, E. Chace ... 544,208
Game apparatus, J. Northrup ... 544,111

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Game illustrating apparatus, baseball, S. R. Crowder ... 543,851
Gas burner, oil, A. F. Dice ... 544,160
Gas engine, F. W. C. Cock ... 544,210
Gas engine, J. Day ... 544,214
Gas manufacturing apparatus, R. D. Wirt ... 544,151
Gas meter, prepayment, T. Thorp et al ... 543,951
Gas process of and apparatus for manufacture of, J. J. Kirkham ... 543,992
Gate. See Flume gate. Folding gate.
Gate, B. F. Canode ... 543,967
Glass, apparatus for bending and shaping sheet, W. Cutler ... 544,248
Glass plates, decorating, S. Paini ... 543,889
Governor, engine, A. Desgoffe ... 544,061
Grading and excavating device, Redmond & Ruff ... 544,051
Grain cleaning device, F. F. Landis ... 544,043, 544,045
Grate, S. L. Jeter ... 544,176
Grille or scroll work, producing, J. P. McHugh ... 544,109
Grinding mill, J. Poulson ... 543,967
Guard. See Railway rail guard.
Gun, breech-loading, P. B. Latrige ... 543,939
Gun, recoil pad, J. R. Winters ... 544,269
Hardening apparatus, W. Whigham ... 543,973
Hand rest, W. B. Mann ... 544,106
Heater. See Water heater.
High or low water alarm, electrical, B. McCabe ... 543,965
Hinge, friction, E. W. Philbrook ... 544,071
Hinge, seat, B. Mess ... 543,883
Hitching device, O. W. Orell ... 543,888
Hoisting machine, J. M. Howard ... 543,936
Hoisting mechanism, G. F. Jennings ... 544,041
Hominy mill, J. Warrington ... 544,145
Hook. See Snap hook.
Hook and eye, K. Bort ... 544,013
Hook for toasting etc., J. Wharfe ... 543,916
Hop picker and cleaner, W. H. Clark ... 544,156
Hopple, kicking, J. E. Turner ... 544,241
Horseshoe, soft tread, J. Benfield ... 543,976
Hose bridge, J. P. Terry ... 544,240
Hose bridge, street car W. H. Baker ... 543,837
Hose coupler, L. J. Houze ... 543,871
Hospital screen, A. S. Spaulding ... 543,906
Hot air registers, air moistening and purifying attachment for, H. Illowizi ... 544,175
Hub attaching device, H. T. Lewis ... 544,181
Hub cap, H. Higgin ... 544,171
Ice cutting machine, M. Fey ... 544,163
Indicating device, visual, C. C. Bramwell ... 514,024
Indicator. See Stool indicator.
Jack. See Boot jack. Lifting jack.
Joint. See Railway rail joint.
Kettle, alarm or bronchitis, H. R. S. Maitland ... 544,283
Key, W. H. Daggett ... 543,852
Key fastener, Cohn & Campbell ... 543,850
Knee pad, Hamilton & Siebenthall ... 543,864
Kneeling or foot bench, H. J. O'Neil ... 544,112
Knife. See Pocket knife.
Lamp, electric arc, J. A. Mosher ... 544,066
Lamp, electric arc, C. E. Scribner ... 543,900
Lamp filament, incandescent, T. A. Edison ... 543,987
Lamp heater attachment, E. F. Pflueger ... 544,116
Lamps, incandescent conductor for electric, T. A. Edison ... 543,985
Latch or bolt fastening, door, J. T. Stone ... 543,908
Lathe, engine, F. S. Perkins ... 544,115
Lawn sprinkler, F. E. Kohler ... 543,993
Lawn sprinkler, H. C. Straley ... 544,134
Lawn sprinkler and fountain, N. L. Rigby ... 544,122
Lifting jack, A. Rhodes ... 544,264
Liquid controlling device, S. Alexander ... 544,078
Liquid meter, Paccaud & De Cappet ... 544,113
Lobster trap, G. Hurst ... 544,100
Lock. See Alarm lock. Bicycle lock. Nut lock. Seal lock. Stud lock.
Locomotive snow or ice flanger, A. F. Priest ... 544,120
Loom drop box mechanism, E. Ingraham ... 544,229
Looms, combined pile wire holder and cutter for, V. Vizet ... 544,142
Lubricator, W. J. Ferguson ... 544,274
Lubricator, H. R. Frisbie ... 544,032
Lubricator, Hogue & Smith ... 544,173
Lubricator, J. Janda ... 544,040
Lubricator, P. S. Whiting ... 543,918
Marker, land, W. M. Lewis ... 543,877
Mat and scraper, combined, J. M. Morton ... 543,999
Match safe, J. Green ... 544,093
Match safe, H. E. Whitney ... 544,018
Mausoleum, R. F. Carter ... 514,086
Meat tenderer, W. G. Mumma ... 544,188
Medical induction coil, J. Tatham ... 544,266
Merry-go-round, J. R. Kidder ... 544,230
Meter. See Electric meter. Gas meter. Liquid meter.
Milk vessel case, W. G. Hart ... 544,097
Milker, cow, Hillman & Gulle ... 543,868
Mill. See Grinding mill. Hominy mill. Windmill.
Miter box, A. D. Goodell ... 544,092
Miter box, T. E. King ... 544,042
Mop, G. B. & R. E. Green ... 544,252
Motor. See Current motor, Electric motor.
Mud pan, H. R. June ... 544,064
Music stand, folding, J. Berg ... 544,022
Nailing machines, nail box for automatic, H. H. Higham ... 544,226
Necktie holder, J. F. Durlacher ... 543,928
Necktie slide, J. G. Maier ... 543,881
Nut lock, C. L. Danforth ... 543,958
Operating table or chair, G. Pitkin ... 544,117
Pad. See Gun recoil pad. Knee pad,
Pan. See Mud pan.
Paper box machine, C. W. Hobbs ... 543,869
Paper holding stand attachment, D. F. Walker ... 544,016
Paris green or fertilizer distributer, J. W. Spangler ... 544,012
Pasteboard bandboxes, machine for making, H. F. Clark ... 544,026
Pen, twin-pointed, A. Kline ... 544,179
Pessary, G. J. Gladman ... 544,091
Phase relations, controlling, C. P. Steinmetz ... 543,907
Piano pedal action, A. F. Norris ... 544,110
Picker. See Hop picker.
Picking machine, S. D. Mosher ... 544,185
Pigeon trap, J. L. Mott, Jr ... 544,186
Pipe fitting, steam, G. H. Webb ... 544,147
Pipe wrench and cutter, F. A. & A. W. Whitney ... 543,953
Planing mill machinery, device for setting up matchers for, C. Schoen ... 544,129
Plant duster, J. B. Hyzer ... 544,174
Planter, L. F. Miller ... 544,184
Planter and marker, combined potato, E. J. Gordon ... 544,220
Planter and tobacco hiller, combined grain, T. L. Gray ... 544,222
Plates, regulating chord of curved, W. Whigham ... 543,917
Plow, H. Westphal ... 544,017
Plow, hand wheel, J. V. Rowlett ... 544,124
Plumbing, sanitary, M. J. Gibbons ... 544,035
Pneumatic press, Schnasse, Jr., & Paffrath ... 544,128
Pocket knife, W. J. Minter ... 543,943
Pocket securing device for pocketbooks, watches, etc., P. Curran ... 544,159
Post. See Fence post.
Pot. See Filtering pot.
Potato digger, L. Fetch ... 543,859
Press. See Baling press. Pneumatic press. Printing press.
Pressure regulator, R. A. Twiss ... 543,911
Primary battery, G. H. Gardner ... 543,931
Printing press, S. Whitlock ... 544,075
Printing press, cylinder, Marriner & Kant ... 543,882
Propeller, Flowers & Fox ... 543,860
Propeller, screw, W. Thompson ... 543,909
Pulley, D. E. Newell ... 543,887
Pulley housing, sash, J. H. Shull ... 544,196
Pump, P. E. Wistrand ... 543,954
Pump, measuring, W. G. Kendall ... 543,872
Punch machine, stencil character, S. D. Hartog, Jr ... 544,169
Purifier, separator, and grader, D. J. Davidson ... 543,927
Rack. See Book rack. Display rack.
Rail chair and nut lock, E. Miller, Jr ... 543,998
Railway and tramway, electric, Claret & Wuilleumier ... 544,209
Railway converter system, electric, T. Harper ... 544,037
Railway, electric, F. Taylor ... 544,198
Railway rail guard and support, E. L. Taylor ... 544,137
Railway rail joint, D. N. Hurlbut ... 544,099
Railway signal, S. Sanborn ... 544,008
Railway signal, electric, J. C. Henry ... 543,933
Railway tie, J. W. Paisley ... 544,192
Railways and tramways, construction and operation of electric, I. W. Heysinger ... 543,867
Railways, conduit system for electric, J. & W. R. Thomas ... 544,056
Refrigerating machine, vacuum, W. J. Ferguson ... 544,273
Register. See Autographic register. Cash register. Fare register. Hot water register.
Register for oil delivered, J. F. & J. H. Lobstrob ... 543,941
Regulator. See Fluid regulator. Pressure regulator. Temperature regulator. Water supply regulator.
Retort lid, J. Henderson ... 543,866
Rheostat, W. O. Meissner ... 544,047
Rheostat controller, C. Landers ... 543,963
Roach trap, L. Marchese ... 544,183
Road making and repairing machine, M. G. Bunnell ... 543,923, 544,272
Routing machine, W. Spalckhaver ... 544,010, 544,011
Rule or gage, spacing, I. H. Mallin ... 543,997
Sandpapering machine, J. Lowry ... 543,873
Sash balance, H. P. Cayce ... 543,848
Sash fastener, J. Lutz ... 543,880
Saw, H. J. Edlund ... 544,162
Saw gummer, McLean & Davies ... 544,067
Scale, self-registering, J. Campbell ... 544,207
Scraper, pavement or sidewalk, C. F. & G. E. Bierbach ... 543,920
Screen. See Hospital screen.
Scrubber, J. Jung ... 544,259
Seal lock, J. Player ... 544,004
Sewing machine grinding and polishing attachment, H. M. Norris ... 544,190
Sewing machine trimming attachment, H. Case ... 543,847
Sextant attachment, S. M. W. Croskery ... 544,212
Shaft, counter, O. S. Walker ... 543,913
Sheep shearing machine, D. & C. T. Silver ... 543,905
Sheet holder and winch, E. G. Kelley ... 544,260
Sheet metal pipe blanks, machine for forming, D. H. Stoll ... 543,971
Shelf, portable, C. S. Stone ... 543,949
Shingle planing machine, W. J. Pugh ... 544,121
Shovel. See Snow shovel.
Sifter, F. A. Iddings ... 544,256, 544,257
Signal. See Car signal. Railway signal.
Signaling system, electric, C. A. Rolfe ... 544,123
Sink and washtub, F. S. Madsen ... 544,105
Skate, Hinsch & Price ... 544,172
Sled, dump, A. H. Rogers ... 544,265
Sleigh, bob, C. E. Gould ... 544,221
Snap hook, W. A. Schleicher ... 514,126
Snow shovel, J. E. Torr ... 543,910
Sowing machine, grass seed, G. H. Preston ... 544,005
Spinning mule, self-acting, B. F. Meyer ... 544,234
Sprinkler. See Lawn sprinkler.
Stair tread, landing, or the like, J. T. Andrews ... 544,204
Stamp battery, Burrows & Martienssen ... 543,846
Stand. See Music stand. Switch stand. Work stand.
Stave crozing machine, D. C. Putnam ... 543,893
Steam boiler, J. D. De Benjumea ... 544,152
Steam boiler, G. Engel ... 543,988
Steam boiler, W. S. Hallowell ... 544,168
Steam boiler, W. Sellers et al ... 544,130
Steam or hot water boiler, sectional, J. R. Bannan ... 544,245
Stencil cutting machine, Hoff & Pickles ... 544,227
Stencil cutting machine, Pickles & Hoff ... 544,193
Stenciling machine, Pickles & Hoff ... 543,891
Stool indicator, piano, C. Brizzi ... 544,154
Store service, apparatus, H. M. Neer ... 544,002
Stove and range and attachment for stoves, W. G. Miller et al ... 544,048
Stove, gas, J. B. Laurent ... 544,275
Stove grate, J. H. Beeby ... 543,841
Stove, heating, J. P. Lynott ... 544,046
Stoves or lamps, extinguisher for oil, W. M. Bowman ... 544,023
Stud lock, screw, C. W. W. Ball ... 543,975
Surgical instrument case, R. W. Johnson ... 543,991
Switch mechanism, interlocking, J. Diefenbach ... 544,089
Switch stand, automatic, N. W. Boyd ... 543,845
Syringe, continuous flow, F. Terramorse ... 544,014
Table. See Operating table.
Telegraphy, system of multiplex, T. B. Dixon ... 543,984
Telephone, J. S. Biggar ... 543,843
Telephone exchange system, C. E. Scribner ... 543,901
Telephone pay stations, coin signal apparatus for, S. Alexander ... 544,077
Telephone switchboard apparatus, C. E. Scribner ... 543,902
Temperature controlling device, electric, S. A. Ekehorn ... 543,929
Temperature regulator, Underhill & Glantzberg ... 544,015
Templet, graduated cloth weight, A. Schaer ... 543,897
Templet, graduated yarn, A. Schaer ... 543,898
Testing machine, H. B. Robischung ... 544,007
Testing samples of garments, system of, M. A. Adler ... 544,202
Thill coupling, E. A. Benner ... 543,977
Thill coupling and support, C. H. Anspach ... 544,205
Thrashing machine, F. F. Landis ... 544,044
Ticket, railway, H. A. Riddle ... 544,052
Tie. See Railway tie.
Tire for vehicle wheels, cushion, H. M. Du Bois ... 544,217
Tire for vehicle wheels, elastic, Ryan & Murphy ... 544,237
Tire, wheel, C. H. Gray ... 543,862
Tires, means for repairing brakes in pneumatic, F. H. Nies ... 544,189
Track sanding apparatus, C. W. Sherburne ... 544,073
Trap. See Lobster trap. Pigeon trap. Roach trap.
Traveling bag, W. F. Williams ... 544,150
Trolley wheel, J. Conway ... 544,157
Trunk strap loop, L. Phelan ... 544,070
Trunks, tray for carrying straw hats in sample, W. C. Richards ... 543,947
Twine holder, W. H. Dustin ... 543,857
Twisting or doubling machine, yarn, S. Ambler ... 544,203
Type case frame, W. Smith ... 544,055
Typewriting machine desk, H. Lauter ... 543,940
Underwear stretcher, A. Ligget ... 543,996
Urinal, S. J. Putnam ... 543,945
Valve, air, F. Gustaveson ... 544,167
Valve or faucet, measuring or registering, M. W. Lydon ... 543,942
Valve, steam engine, C. W. Thompson ... 544,199
Vehicle, dumping, O. E. Davidson ... 544,060
Vehicle starting device, J. Darling ... 544,088
Vehicle step, H. C. Swan ... 544,136
Velocipede hobby horse, J. W. Latty ... 543,874
Vent and drain box, sanitary, E. Hayward ... 543,961
Ventilator, J. Leather ... 543,935
Voting machine, S. Ducas ... 544,218
Wagon bed attachment, H. M. Hickman ... 544,225
Wagon body, B. L. Bibb ... 543,956
Wagon, delivery, W. Leonhardt ... 544,232
Wagon running gear, J. Bennett ... 544,271
Washing machine, C. A. Brewer ... 544,246
Washing machine, F. D. Harding ... 543,990
Watch bow fastener, E. H. Hunter ... 544,039
Water closet bowl, M. Garland ... 544,251
Water closet seat support, A. C. Tiedemann ... 543,952
Water heater, Wilson & Bernstein ... 544,019
Water supply regulator, R. E. Convert ... 514,027
Wells, device for cleaning out tubed, Welter & Sacksteder ... 544,148
Wheel. See Fifth wheel. Trolley wheel.
Windmill, H. S. Hopper ... 544,228
Window, J. B. Grattarola ... 544,164
Window, bay, Turner & Harrington ... 544,242
Window casing and means for securing sash therein, Randel & French ... 544,050
Wire drawing machine, V. E. Edwards ... 543,858
Wire reeling machine, C. H. Morgan ... 543,884
Wire spokes, machine for manufacture of swaged, Watson & Vaughan ... 543,914
Work stand, C. E. Lincoln ... 544,182
Wrapper, mailing, F. W. Wright ... 544,270
Wrappers to newspapers, machine for applying, J. & I. P. Kissell ... 543,873
Wrench. See Pipe wrench.
Wrench, F. L. Coes ... 543,925

DESIGNS.

Cuspidor case, C. Hofmann ... 24,530
Portiere rope, B. Cronenberg ... 24,531
Spoon, G. P. Tilton ... 24,528
Toy, S. Alland ... 24,529

TRADE MARKS.

Antiseptics, Speyer & Grund ... 26,906
Blind ladder tapes, J. Carr & Sons ... 26,891
Brushes, J. J. Adams & Company ... 26,911
Chemical and pharmaceutical and toilet preparations, certain named, Collier Drug Company ... 26,905
Chemical and colors, G. Siegle & Company ... 26,909
Cigars, G. Pierce ... 26,897
Combs, toilet, Butler Hard Rubber Company ... 26,910
Cream of tartar substitute, Nichols Chemical Company ... 26,899
Duck, Harding, Whitman & Company ... 26,894
Dusters and polishing cloths, Jones Brothers & Company ... 26,895
Gelatine, baking powder, and flavoring extracts, P. W. Thayer ... 26,900
Knitted fabrics and garments, O. Osborne ... 26,892
Knives, forks, spoons, and other articles of table service made of steel and tinned, R. Wallace & Sons Manufacturing Company ... 26,912
Linen goods, certain named, J. S. Brown & Sons ... 26,893
Medical compound, certain named, Afta Pharmacy Company ... 26,903
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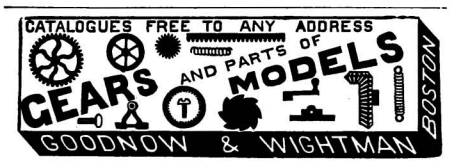

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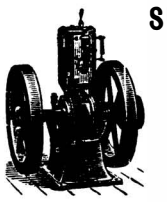

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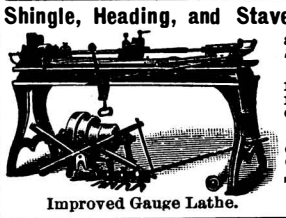

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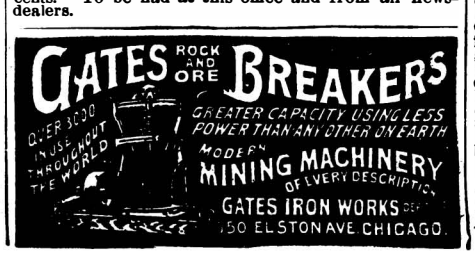
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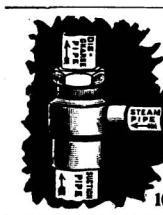

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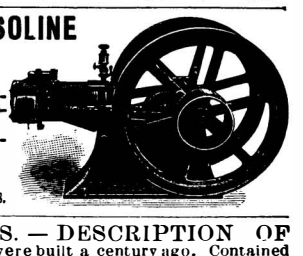

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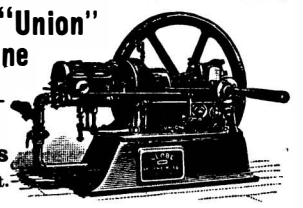

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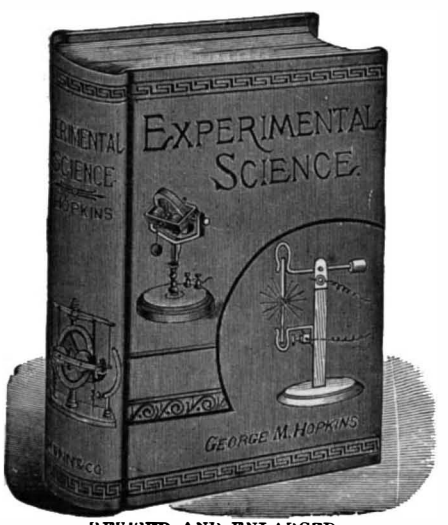

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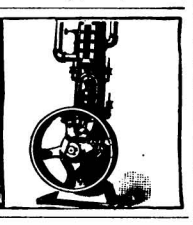

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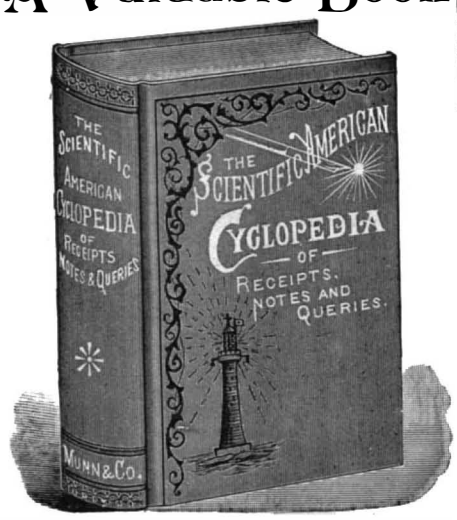

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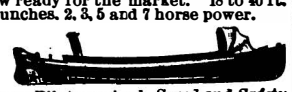

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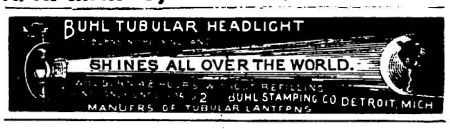

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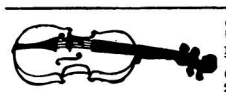

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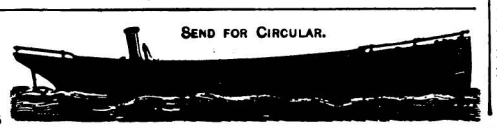

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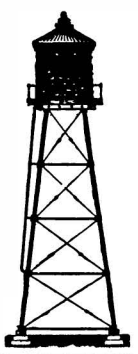

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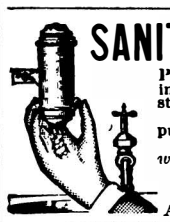

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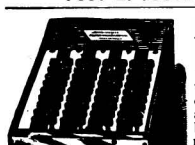

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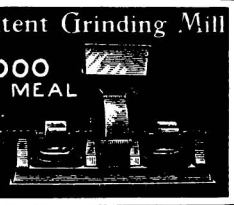

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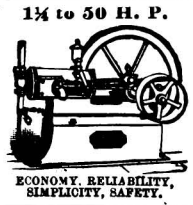

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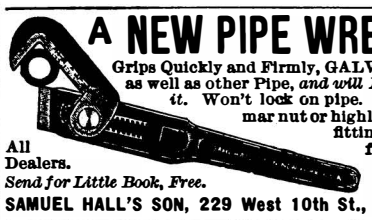

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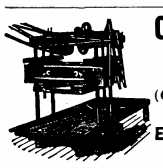

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